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THE HUMANIZATION OF THE TEACHING OF MATHEMATICS[1]

WHEN the distinguished chairman of your mathematical conference did me the honor to request me to speak to you, he was generous enough, whether wisely or unwisely, to leave the choice of a subject to my discretion, merely stipulating that, whatever the title might be, the address itself should bear upon the professional function of those men and women who are engaged in teaching mathematics in secondary schools. Inexpertness, it has been said, is the curse of the world; and one may, not unnaturally, feel some hesitance in undertaking a task that might seem to resemble the rôle of a physician when, as sometimes happens, he is called upon to treat a patient whose health and medical competence surpass his own. I trust I am not wanting in that natural feeling. In the present instance two considerations have enabled me to overcome it. One of them is that, having had some experience in teaching mathematics in secondary schools, I might, it seemed to me, regard that experience, though it was gained more than a score of years ago, as giving something like a title to be heard in your counsels. The other consideration is that, in regard to the teaching of mathematics, whether in secondary schools or in colleges, I have acquired a certain conviction, a pretty firm conviction, which, were it properly presented, you would doubtless be generous enough and perhaps ingenious

[1] Address given at the meeting of the Michigan School Masters' Club, at Ann Arbor, March 28, 1912.

enough to regard as having some sort of likeness to a message.

My conviction is, that hope of improvement in mathematics teaching, whether in secondary schools or in colleges, lies mainly in the possibility of humanizing it. It is worth while to remember that our pupils are human beings. What it means to be a human being we all of us presumably know pretty well; indeed we know it so well that we are unable to tell it to one another adequately; and, just because we do so well know what it means to be a human being, we are prone to forget it as we forget, except when the wind is blowing, that we are constantly immersed in the earth's atmosphere. To humanize the teaching of mathematics means so to present the subject, so to interpret its ideas and doctrines, that they shall appeal, not merely to the computatory faculty or to the logical faculty but to all the great powers and interests of the human mind. That mathematical ideas and doctrines, whether they be more elementary or more advanced, admit of such a manifold, liberal and stimulating interpretation, and that therefore the teaching of mathematics, whether in secondary schools or in colleges, may become, in the largest and best sense, human, I have no doubt. That mathematical ideas and doctrines do but seldom receive such interpretation and that accordingly the teaching of mathematics is but seldom, in the largest and best sense, human, I believe to be equally certain. That the indicated humanization of mathematical teaching, the bringing of the matter and the spirit of mathematics to bear, not merely upon certain fragmentary faculties of the mind, but upon the whole mind, that this is a great desideration is, I assume, beyond dispute.

How can such humanization be brought about? The answer, I believe, is not far to seek. I do not mean that the answer is easy to discover or easy to communicate. I mean that the game is near at hand and that it is not difficult to locate it, though it may not be easy to capture it. The difficulty inheres, I believe, in our conception of mathematics itself; not so much in our conception of what mathematics, in a definitional sense, is, for that sense of what mathematics is has become pretty clear in our day, but in our sense or want of sense of what mathematics, whatever it may be, humanly signifies. In order to humanize mathematical teaching it is necessary, and I believe it is sufficient, to come under the control of a right conception of the human significance of mathematics. It is sufficient, I mean to say, and it is necessary, greatly to enlarge, to enrich and to vitalize our sense of what mathematics, regarded as human enterprise, signifies.

What does mathematics, regarded as an enterprise of the human spirit, signify? What is a just and worthy sense of the human significance of mathematics?

To the extent in which any of us really succeeds in answering that question worthily, his teaching will have the human quality, in so far as his teaching is, in point of external circumstance, free to be what it would. I believe it is important to put the question, and it is with the putting of it rather than with the proposing of an answer to it that I am here at the outset mainly concerned. For any one who is really to acquire possession of an answer that is worthy must win the answer for himself. I need not say to you that such an acquisition as a worthy answer to this kind of question does not belong to the category of things that may be lent or borrowed, sold or bought, donated or acquired by gift. No doubt the answers we may severally win will differ as our temperaments differ. Yet the matter is not solely

a matter of temperament. It is much more a matter first of knowledge and then of the evaluation of the knowledge and of its subject. To the winning of a worthy sense of the human significance of mathematics two things are indispensable, knowledge and reflection: knowledge of mathematics and reflection upon it. To the winning of such a sense it is essential to have the kind of knowledge that none but serious students of mathematics can gain. Equally essential is another thing and this thing students of mathematics in our day do not, or do but seldom, gain. I mean the kind of insight and the liberality of view that are to be acquired only by prolonged contemplation of the nature of mathematics and by prolonged reflection upon its relations of contrast and similitude to the other great forms of spiritual activity.

The question, though it is a question about mathematics, is not a mathematical question, it is a philosophical question. And just because it is a philosophical question, mathematicians, despite the fact that one of the indispensable qualifications for considering it is possessed by them alone, have in general ignored it. They have, in general, ignored it, and their ignoring of it may help to explain the curious paradox that whilst the world, whose mathematical knowledge varies from little to less, has always as if instinctively held mathematical science in high esteem, it has at the same time usually regarded mathematicians as eccentric and abnormal, as constituting a class apart, as being something more or something less than human. It may explain, too, I venture to believe it does partly explain, both why it is that in the universities the number of students attracted to advanced lectures in mathematics compared with the numbers drawn to advanced courses in some other great subjects not inherently more attractive, is so small; and why it is that, among the multitudes who pursue mathematics in the secondary schools, only a few find in the subject anything like delight. For I do not accept the traditional and still current explanation, that the phenomenon is due to a well-nigh universal lack of mathematical faculty. I maintain, on the contrary, that a vast majority of mankind possess mathematical faculty in a very considerable degree. That the average pupil's interest in mathematics is but slight, is a matter of common knowledge. His lack of interest is, in my opinion, due, not to a lack of the appropriate faculty in him, but to the circumstance that he is a human being, whilst mathematics, though it teems with human interest, is not presented to him in its human guise.

If you ask the world—represented, let us say, by the man in the street or in the market place or the field—to tell you its estimate of the human significance of mathematics, the answer of the world will be, that mathematics has given mankind a metrical and computatory art essential to the effective conduct of daily life, that mathematics admits of countless applications in engineering and the natural sciences, and finally that mathematics is a most excellent instrumentality for giving mental discipline. Such will be the answer of the world. The answer is intelligible, it is important, and it is good so far as it goes; but it is far from going far enough and it is not intelligent. That it is far from going far enough will become evident as we proceed. That the answer is not intelligent is evident at once, for the first part of it seems to imply that the rudimentary mathematics of the carpenter and the counting-house is scientific, which it is not; the second part of the answer is but an echo by the many of the voice of the few; and, as to the final part, the world's

conception of intellectual discipline is neither profound nor well informed but is itself in sorry need of discipline.

If, turning from the world to a normal mathematician, you ask him to explain to you the human significance of mathematics, he will repeat to you the answer of the world, of course with far more appreciation than the world has of what the answer means, and he will supplement the world's response by an important addition. He will add, that is, that mathematics is the exact science, the science of exact thought or of rigorous thinking. By this he will not mean what the world would mean if the world employed, as sometimes it does employ, the same form of words. He will mean something very different. Especially if he be, as I suppose him to be, a normal mathematician of the modern critical type, he will mean that mathematics is, in the oft-cited language of Benjamin Peirce, "the science that draws necessary conclusions;" he will mean that, in the felicitious words of William Benjamin Smith, "mathematics is the universal art apodictic;" he will mean that mathematics is, in the nicely technical phrase of Pieri, "a hypothetico-deductive system." If you ask him whether mathematics is the science of rigorous thinking about *all* the things that engage the thought of mankind or only about a few of them, such as numbers, figures, certain operations, and the like, the answer he will give you depends. If he be a normal mathematician of the elder school, he will say that mathematics is the science of rigorous thinking about only a relatively few things and that these are such as you have exemplified. And if now, with a little Socratic persistence, you press him to indicate the human significance of a science of rigorous thinking about only a few of the countless things that engage human thought, his answer will give you but little beyond a repetition of the above-mentioned answer of the world. But if he be a normal mathematician of the modern critical type, he will say that mathematics is the science of rigorous thinking about all the things that engage human thought, about *all* of them, he will mean, in the sense that thinking, as it approaches perfection, tends to assume certain definite forms, that these forms are the same whatever the subject matter of the thinking may be, and that mathematics is the science of these forms *as forms*. If you respond, as you well may respond, that, in accordance with this ontological conception of mathematics, this science, instead of thinking about *all*, thinks about *none*, of the concrete things of interest to human thought, and that accordingly Mr. Bertrand Russell was right in saying that "mathematics is the science in which one never knows what one is talking about nor whether what one says is true"—if you respond that, from the point of view above assumed, that delicious *mot* of Mr. Russell's must be solemnly held as true, and then if, in accordance with your original purpose, you once more press for an estimation of the human significance of such a science, I fear that the reply, if your interlocutor is a mathematician of the normal type, will contain little that is new beyond the assertion that the science in question is very interesting, where, by interesting, he means, of course, interesting to mathematicians. It is true that Professor Klein has said: "Apart from the fact that pure mathematics can not be supplanted by anything else as a means for developing the purely logical faculties of the mind, there must be considered here as elsewhere the necessity of the presence of a few individuals in each country developed in a far higher degree than the rest, for the purpose of keeping up and gradually raising the *general*

standard. Even a slight raising of the general level can be accomplished only when some few minds have progressed far ahead of the average.'' Here indeed we have, in these words of Professor Klein, a hint, if only a hint, of something better. But Professor Klein is not a mathematician of the normal type, he is hypernormal. If, in order to indicate the human significance of mathematics regarded as the science of the forms of thought as forms, your normal mathematician were to say that these forms constitute, of themselves, an infinite and everlasting world whose beauty, though it is austere and cold, is pure, and in which is the secret and citadel of whatever order and harmony our concrete universe contains, it would yet be your right and your duty to ask, as the brilliant author of ''East London Visions'' once asked me, namely, what is the human significance of ''this majestic intellectual cosmos of yours, towering up like a million-lustered iceberg into the arctic night,'' seeing that, among mankind, none is permitted to behold its more resplendent wonders save the mathematician himself? But the normal mathematician will not say what I have just now supposed him to say; he will not say it, because he is, by hypothesis, a normal mathematician, and because, being a normal mathematician, he is exclusively engaged in exploring the iceberg. A farmer was once asked why he raised so many hogs. ''In order,'' he said, ''to buy more land.'' Asked why he desired more land, his answer was, ''in order to raise more corn.'' Being asked to say why he would raise more corn, he replied that he wished to raise more hogs. If you ask the normal mathematician why he explores the iceberg so much, his answer will be, in effect at least, ''in order to explore it more.'' In this exquisite circularity of motive, the farmer and the normal mathematician are well within their rights. They are within their rights just as a musician would be within his rights if he chanced to be so exclusively interested in the work of composition as never to be concerned with having his creations rendered before the public and never to attempt a philosophic estimate of the human worth of music. The distinction involved is not the distinction between human and inhuman, between social and anti-social; it is the distinction between what is human *or* inhuman, social or anti-social, and what is neither the one nor the other. No one, I believe, may contest the normal mathematician's right as a mathematical student or investigator to be quite indifferent as to the social value or the human worth of his activity. Such activity is to be prized just as we prize any other natural agency or force that, however undesignedly, yet contributes, sooner or later, directly or indirectly, to the weal of mankind. The fact is that, among motives in research, scientific curiosity, which is neither moral nor immoral, is far more common and far more potent than charity or philanthropy or benevolence. But when the mathematician passes from the rôle of student or investigator to the rôle of teacher, that right of indifference ceases, for he has passed to an office whose functions are social and whose obligations are human. It is not his privilege to chill and depress with the encasing fogs of the iceberg. It is his privilege and his duty, in so far as he may, to disclose its ''million-lustered'' splendors in all their power to quicken and illuminate, to charm and edify, the whole mind.

The conception of mathematics as the science of the forms of thought as forms, the conception of it as the refinement, prolongation and elaboration of pure logic, is, as you are doubtless aware, one of the great outcomes, perhaps I should say it is

the culminating philosophical outcome, of a century's effort to ascertain what mathematics, in its intimate structure, is. This conception of what mathematics is comes to its fullest expression and best defense, as you doubtless know, in such works as Schroeder's "Algebra der Logik," Whitehead's "Universal Algebra," Russell's "Principles of Mathematics," Peano's "Formulario Mathematico," and especially in Whitehead and Russell's monumental "Principia Mathematica." I cite this literature because it tells us what, in a definitional sense, the science in which the normal mathematician is exclusively engaged, is. If we wish to be told what that science humanly signifies, we must look elsewhere; we must look to a mathematician like Plato, for example, or to a philosopher like Poincaré, but especially must we look to our own faculty for discerning those fine connective things—community of aim, interformal analogies, structural similitudes —that bind all the great forms of human activity and aspiration—natural science, theology, philosophy, jurisprudence, religion, art and mathematics—into one grand enterprise of the human spirit.

In the autumn of 1906 there was published in *Poet Lore* a short poem which, though it says nothing explicitly of mathematics, yet admits of an interpretation throwing much light upon the human significance of the science and indicating well, I think, the normal mathematician's place in the world of spiritual interests. The author of the poem is my excellent friend and teacher, Professor William Benjamin Smith, mathematician, philosopher, poet and theologian. I have not asked his permission to interpret the poem as I shall invite you to interpret it. What its original motive was I am not informed—it may have been the exceeding beauty of the ideas expressed in it or the harmonious mingling of their light with the melody of their song. The title of the poem is "The Merman and the Seraph." As you listen to the reading of it, I shall ask you to regard the merman as representing the normal mathematician and the seraph as representing, let us say, the life of the emotions in their higher reaches and their finer susceptibilities.

I

Deep the sunless seas amid,
Far from Man, from Angel hid,
Where the soundless tides are rolled
Over Ocean's treasure-hold,
With dragon eye and heart of stone,
The ancient Merman mused alone.

II

And aye his arrowed Thought he wings
Straight at the inmost core of things—
As mirrored in his Magic glass
The lightning-footed Ages pass,—
And knows nor joy nor Earth's distress,
But broods on Everlastingness.
"Thoughts that love not, thoughts that hate not,
Thoughts that Age and Change await not,
All unfeeling,
All revealing,
Scorning height's and depth's concealing,
These be mine—and these alone!"—
Saith the Merman's heart of stone.

III

Flashed a radiance far and nigh
As from the vertex of the sky,—
Lo! a Maiden beauty-bright
And mantled with mysterious might
Of every power, below, above,
That weaves resistless spell of Love.

IV

Through the weltering waters cold
Shot the sheen of silken gold;
Quick the frozen Heart below
Kindled in the amber glow;
Trembling Heavenward Nekkan yearned
Rose to where the Glory burned.
"Deeper, bluer than the skies are,
Dreaming meres of morn thine eyes are
All that brightens
Smile or heightens
Charm is thine, all life enlightens,

Thou art all the soul's desire.''—
Sang the Merman's Heart of Fire.
''Woe thee, Nekkan! Ne'er was given
Thee to walk the ways of Heaven;
Vain the vision,
Fate's derision,
Thee that raps to realms elysian,
Fathomless profounds are thine''—
Quired the answering voice divine.

V

Came an echo from the West,
Pierced the deep celestial breast;
Summoned, far the Seraph fled,
Trailing splendors overhead;
Broad beneath her flying feet,
Laughed the silvered ocean-street.

VI

On the Merman's mortal sight
Instant fell the pall of Night;
Sunk to the sea's profoundest floor
He dreams the vanished Vision o'er,
Hears anew the starry chime,
Ponders aye Eternal Time.
''Thoughts that hope not, thoughts that fear not,
Thoughts that Man and Demon veer not
Times unending
Comprehending,
Space and worlds of worlds transcending,
These are mine—but these alone!''—
Sighs the Merman's heart of stone.

I have said that the poem, if it receive the interpretation that I have invited you to give it, throws much light on the human significance of mathematics and indicates well the place of the normal mathematician in the world of spiritual interests. No doubt the place of the merman and the place of the angel are not the same: no doubt the world of whatsoever in thought is passionless, infinite and everlasting, and the world of whatsoever in feeling is high and beauteous and good are distinct worlds, and they are sundered wide in the poem. But, though in the poem they are held widely apart, in the poet they are united. For the song is not the merman's song nor are its words the words of the seraph. It is the voice of the poet—a voice of man. The merman's world and the world of the seraph are not the same, they are very distinct; in conception they are sundered; they may be sundered in life, but in life it need not be so. The merman indeed is confined to the one world and the seraph to the other, but man, a man unless he be a merman, may inhabit them both. For the angel's denial, the derision of fate, is not spoken of man, it is spoken of the merman; and the merman's sigh is not his own, it is a human sigh—so lonely seems the merman in the depths of his abode.

No, the world of interests of the human spirit is not the merman's world alone nor the seraph's alone. It is not so simple. It is rather a cluster of worlds, of worlds that differ among themselves as differ the lights by which they are characterized. As differ the lights. The human spirit is susceptible of a variety of lights and it lives at once in a corresponding variety of worlds. There is perception's light, commonly identified with solar radiance or with the radiance of sound, for music, too, is, to the spirit, a kind of illumination: perceptional light, in which we behold the colors, forms and harmonies of external nature: a beautiful revelation—a world in which any one might be willing to spend the remainder of his days if he were but permitted to live so long. And there is imagination's light, disclosing a new world filled with wondrous things, things that may or may not resemble the things revealed in perception's light but are never identical with them: light that is not superficial nor constrained to paths that are straight but reveals the interiors of what it illuminates and phases that look away. Again, there is the light of thought, of reason, of logic, the light of analysis, far dimmer than perception's light, dimmer, too, than that of imagination, but far more penetrating and far more

ubiquitous than either of them, disclosing things that curiously match the things that they disclose and countless things besides, namely, the world of ideas and the relations that bind them: a cosmic world, in the center whereof is the home of the merman. There remains to be named a fourth kind of light. I mean the light of emotion, the radiance and glory of things that, save by gleams and intimations, are not revealed in perception or in imagination or in thought: the light of the seraph's world, the world of the good, the true and the beautiful, of the spirit of art, of aspiration and of religion.

Such, in brief, is the cluster of worlds wherein dwell the spiritual interests of the human beings to whom it is our mission to teach mathematics. My thesis is that it is our privilege to show, in the way of our teaching it, that its human significance is not confined to one of the worlds but, like a subtle and ubiquitous ether, penetrates them all. Objectively viewed, conceptually taken, these worlds, unlike the spheres of the geometrician, do not intersect—a thing in one of them is not in another; but the things in one of them and the things in another may own a fine resemblance serving for mutual recall and illustration, effecting transfer of attention—transformation as the mathematicians call it—from world to world; for whilst these worlds of interest, objectively viewed, have naught in common, yet subjectively they are united, united as differing mansions of the house of the human spirit. A relation, for example, between three independent variables exists only in the gray light of thought, only in the world of the merman; the habitation of the geometric locus of the relation is the world of imagination; if a model of the locus be made or a drawing of it, this will be a thing in the world of perception; finally, the wondrous correlation of the three things, or the spiritual qualities of them—the sensuous beauty of the model or the drawing, the unfailing validity of the given relation holding as it does throughout "the cycle of the eternal year," the immobile presence of the locus or image poised there in eternal calm like a figure of justice—these may serve, in contemplating them, to evoke the radiance of the seraph's world: and thus the circuit and interplay, ranging through the world of imagination and the world of thought from what is sensuous to what is supernal, is complete. It would not have seemed to Plato, as it may seem to us, a far cry from the prayer of a poet to the theorem of Pythagoras, for example, or to that of Archimedes respecting a sphere and its circumscribing cylinder. Yet I venture to say, that calm reflection upon the existence and nature of such a theorem—cloistral contemplation, I mean, of the fact that it is really true, of its serene beauty, of its silent omnipresence throughout the infinite universe of space, of the absolute exactitude and invariance of its truth from everlasting to everlasting—will not fail to yield a sense of reverence and awe akin to the feeling that, for example, pervades this choral prayer by Sophocles:

"Oh! that my lot may lead me in the path of holy innocence of word and deed, the path which august laws ordain, laws that in the highest empyrean had their birth, of which Heaven is the father alone, nor did the race of mortal men beget them, nor shall oblivion put them to sleep. The god is mighty in them and he groweth not old."

But why should we think it strange that interests, though they seem to cluster about opposite poles, are yet united by a common mood? Of the great world of human interests, mathematics is indeed but a part; but is a central part, and, in a profound

and precious sense, it is "the eternal type of the wondrous whole." For poetry and painting, sculpture and music—art in all its forms—philosophy, theology, religion and science, too, however passional their life and however tinged or deeply stained by local or temporal circumstance, yet have this in common: they all of them aim at values which transcend the accidents and limitations of every time and place; and so it is that the passionlessness of the merman's thought, the infiniteness of the kind of being he contemplates and the everlastingness of his achievements enter as essential qualities into the ideals that make the glory of the seraph's world. I do not forget, in saying this, that, of all theory, mathematical theory is the most abstract. I do not forget that mathematics therefore lends especial sharpness to the contrast in the Mephistophelian warning:

> Gray, my dear friend, is all theory,
> Green the golden tree of life.

Yet I know that one who loves not the gray of a naked woodland has much to learn of the esthetic resources of our northern clime. A mathematical doctrine, taken in its purity, is indeed gray. Yet such a doctrine, a world-filling theory woven of gray relationships finer than gossamer but stronger than cables of steel, leaves upon an intersecting plane a tracery surpassing in fineness and beauty the exquisite artistry of frost-work upon a windowpane. Architecture, it has been said, is frozen music. Be it so. Geometry is frozen architecture.

No, the belief that mathematics, because it is abstract, because it is static and cold and gray, is detached from life, is a mistaken belief. Mathematics, even in its purest and most abstract estate, is not detached from life. It is just the ideal handling of the problems of life, as sculpture may idealize a human figure or as poetry or painting may idealize a figure or a scene. Mathematics is precisely the ideal handling of the problems of life, and the central ideas of the science, the great concepts about which its stately doctrines have been built up, are precisely the chief ideas with which life must always deal and which, as it tumbles and rolls about them through time and space, give it its interests and problems, and its order and rationality. That such is the case a few indications will suffice to show. The mathematical concepts of constant and variable are represented familiarly in life by the notions of fixedness and change. The concept of equation or that of an equational system, imposing restriction upon variability, is matched in life by the concept of natural and spiritual law, giving order to what were else chaotic change and providing partial freedom in lieu of none at all. What is known in mathematics under the name of limit is everywhere present in life in the guise of some ideal, some excellence high-dwelling among the rocks, an "ever flying perfect" as Emerson calls it, unto which we may approximate nearer and nearer, but which we can never quite attain, save in aspiration. The supreme concept of functionality finds its correlate in life in the all-pervasive sense of interdependence and mutual determination among the elements of the world. What is known in mathematics as transformation—that is, lawful transfer of attention, serving to match in orderly fashion the things of one system with those of another—is conceived in life as a process of transmutation by which, in the flux of the world, the content of the present has come out of the past and in its turn, in ceasing to be, gives birth to its successor, as the boy is father to the man and as things, in general, be-

come what they are not. The mathematical concept of invariance and that of infinitude, especially the imposing doctrines that explain their meanings and bear their names—what are they but mathematicizations of that which has ever been the chief of life's hopes and dreams, of that which has ever been the object of its deepest passion and of its dominant enterprise, I mean the finding of worth that abides, the finding of permanence in the midst of change, and the discovery of the presence, in what has seemed to be a finite world, of being that is infinite? It is needless further to multiply examples of a correlation that is so abounding and complete as indeed to suggest a doubt whether it be juster to view mathematics as the abstract idealization of life than to regard life as the concrete realization of mathematics.

Finally, I wish to emphasize the fact that the great concepts out of which the so-called higher mathematical branches have grown—the concepts of variable and constant, of function, class and relation, of transformation, invariance, and group, of finite and infinite, of discreteness, limit, and continuity—I wish, in closing, to emphasize the fact that these great ideas of the higher mathematics, besides penetrating life, as we have seen, in all its complexity and all its dimensions, are omnipresent, from the very beginning, in the *elements* of mathematics as well. The notion of group, for example, finds easy and beautiful illustration, not only among the simpler geometric motions and configurations, but even in the ensemble of the very integers with which we count. The like is true of the distinction of finite and infinite, and of the ideas of transformation, of invariant, and nearly all the rest. Why should the presentation of them have to await the uncertain advent of graduate years of study? For life already abounds, and the great ideas that give it its interests, order and rationality, that is to say, the focal concepts of the higher mathematics, are everywhere present in the elements of the science as glistening bassets of gold. It is our privilege, in teaching the elements, to avail ourselves of the higher conceptions that are present in them; it is our privilege to have and to give a lively sense of their presence, their human significance, their beauty and their light. I do not advocate the formal presentation, in secondary schools, of the higher conceptions, in the way of printed texts, for the printed text is apt to be arid and the letter killeth. What I wish to recommend is the presentation of them, as opportunity may serve, in Greek fashion, by means of dialectic, face to face, voice answering to voice, animated with the varying moods and motions and accents of life—laughter, if you will, and the lightning of wit to cheer and speed the slower currents of sober thought. Of dialectic excellence, Plato at his best, as in "Phædo" or the "Republic," gives us the ideal model and eternal type. But Plato's ways are frequently circuitous, wearisome and long. They are ill suited to the manners of a direct and undeliberate age; and we must find, each for himself, a shorter course. Somebody imbued with the spirit of the matter, possessed of ample knowledge and having, besides, the requisite skill and verve ought to write a book showing, in so far as the printed page can be made to show, how naturally and swiftly and with what a delightful sense of emancipation and power thought may pass by dialectic paths from the traditional elements of mathematics both to its larger concepts and to a vision of their bearings on the higher interests of life. I need not say that such a handling of ideas implies

much more than a verbal knowledge of their definitions. It implies familiarity with the doctrines that unfold the meanings of the ideas defined. It is evident that, in respect of this matter, the scripture must read: Knowing the doctrine is essential to living the life.

C. J. KEYSER

COLUMBIA UNIVERSITY

BENJAMIN FRANKLIN THOMAS

No more unexpected and startling announcement ever came to the writer than that of the death of Professor Thomas last summer. Only a few weeks before he was apparently in rugged health and as much interested as ever in the various phases of his department of science and its applications. The workers die but the work goes on.

Professor Thomas was born at Palmyra, Ohio, October 14, 1850, and died near his summer home in Maine, July 4, 1911. He received his preparation for college under private tutorage in Fox Lake, Wisconsin, and took the degree of Master of Science at Ripon College in 1874. Then followed one year at the Fort Berthold Indian Reservation in Dakota, two years as instructor at Carlton College in Minnesota and three years as a graduate student at the Massachusetts Institute of Technology and research assistant at the Stevens Institute in Hoboken. At this last institution he earned the degree of Doctor of Philosophy in 1880. The next five years he spent as professor of physics at the University of Missouri. In 1885 he was elected to the same chair in succession to Dr. T. C. Mendenhall at the Ohio State University. To this institution he gave twenty-six years of undivided and efficient service in the cause of education. This term of service covered the critical formative period while the institution was evolving from a small "College of Agriculture and Mechanic Arts" into the great state university of the present. His compelling logic, clear mental grasp of a difficult situation, and his exceptional gift for orderly statement made his services of great value in faculty meetings, in hearings before legislative committees, and as an expert witness in important cases of litigation.

Professor Thomas was early in foreseeing the immense expansion likely to come in applied electricity, and in 1889 he was instrumental in obtaining from the legislature an appropriation for a building and its equipment to accommodate a course in electrical engineering. This was probably the first college building ever built solely for the purpose of teaching this branch of engineering. His foresight has received abundant justification in a number of graduates in this course who have shed luster on their chosen profession and on their alma mater.

Professor Thomas's especial interest was in the subject of electrical measurements and electrical applications. He was unusually successful in developing the courses in advanced electrical measurements for engineering students; and by careful planning and persistent effort, carried on steadily through many years, he succeeded in getting together a magnificent equipment for this work. At the same time he elaborated a strong course of instruction which matched the fine equipment for effective use. He was a remarkably skilful experimenter in the study of rapidly varying electrical phenomena. His oscillograms of electric discharges and of waves of electric pressure and current are the most beautiful the writer has ever seen.

Professor Thomas's practical work as an electrical expert early led him to a thorough study of the photometry of arc and incandescent lamps, and enabled him to give valuable aid in electric lighting to many great institutions of the state, such as the Ohio Soldiers' and Sailors' Orphans Home, the state house at Columbus and the State Hospitals at Athens, Dayton and Toledo. He was for a number of years director of the Ohio Meteorological Bureau before it was merged into the United States Weather Bureau. He was also the representative for the state in the meetings called by the Bureau of Standards in Washington to confer on the subject of correct weights and measures.

Among the public positions filled by Professor Thomas was that of member of the board of examiners at the International Electrical Exhibition in Philadelphia in 1884 and of the Jury of Awards in the Department of Electricity at the Columbian Exhibition in 1893. At the latter he was placed in charge of a very elaborate test of the life and efficiency of incandescent electric lamps. The results of this prolonged test unfortunately were never published by the government. He was an expert judge of electrical instruments, machinery and processes, and he was in consequence much in demand as a consulting engineer to design the electric plants of large establishments.

As a teacher Professor Thomas excelled in the clearness and precision of his statements. These were matched by the success of his experimental demonstrations. From his students he invariably demanded solid, substantial work; he was impatient with careless or slovenly ways either in the class-room or the laboratory, and constantly held up to his classes high standards of attainment.

The new and substantial physics building at the Ohio State University is a monument to his persistent effort and to his good judgment in planning and working out various details for convenience and efficiency. In the work of his department and all that pertained to it he was indefatigable; to it he gave more than the full measure of time and energy.

Professor Thomas was a genial friend; none more so. The writer was favored with that friendship for many years, and he here gladly gives expression to his deep appreciation of all that this friendship meant to him. Only the bereaved wife, the son and the daughter know what it means to lose a faithful husband and a fond father.

Henry S. Carhart

ATTENDANCE AT GERMAN UNIVERSITIES

The Deutscher Universitäts-Kalender for the summer semester of 1912, which has just been published, contains a table showing the enrollment of the twenty-one German universities during the winter semester of 1911–12. The table shows that there were in attendance 57,398 students, as contrasted with 57,200 for the preceding summer semester. This is, however, exclusive of 5,563 auditors, who, if added, would run the grand total to 62,961, as against 61,274 during the summer semester. The University of Berlin continues to lead the list with an enrollment of 9,829 matriculated students, of whom over 5,000 are enrolled in the faculty of philosophy, about 2,000 in the faculty of medicine (including pharmacy and dentistry), 2,412 in law, and 427 in Protestant theology. In addition there were in attendance 776 male auditors and 258 female auditors, bringing the total enrollment of the university during the past winter semester to 10,863, as against 10,720 during the winter semester of 1910–11. The Prussian University of Berlin is followed by the Bavarian University of Munich, which had an enrollment of 6,797 matriculated students and 782 auditors. The Saxon University of Leipzig ranks third with 5,170 matriculated students and 925 auditors. The remaining universities rank in point of attendance as follows: Bonn, 4,279; Breslau, 3,113; Halle, 3,112; Göttingen, 2,637; Freiburg, 2,614; Heidelberg, 2,418; Münster, 2,314; Strassburg, 2,298; Marburg, 2,014; Tübingen, 1,994; Jena, 1,831; Königsberg, 1,694; Kiel, 1,661; Würzburg, 1,583; Giessen, 1,428; Erlangen, 1,251; Greifswald, 1,228; Rostock, 955; the figures in each case being inclusive of auditors. During the winter semester of 1893–94 the universities ranked as follows: (1) Berlin, (2) Munich, (3) Leipzig, (4) Halle, (5) Würzburg, (6) Bonn, (7) Breslau, (8) Tübingen, (9) Erlangen, (10) Freiburg, (11) Heidelberg, (12) Strassburg, (13) Marburg, (14) Göttingen, (15) Greifswald, (16) Königsberg, (17) Jena, (18) Giessen, (19) Kiel, (20) Rostock, and (21) Münster. It will thus be seen that there has been no change in the order of the three largest universities, but that several institutions which were in the lower half of the list eighteen years ago, have grown sufficiently to advance

them into the first division, notably Münster, Strassburg and Göttingen.

Of the 57,398 matriculated students, 2,853 were registered in Protestant theology, 1,770 in Catholic theology, 11,632 in law, 13,870 in medicine, and 27,273 in the faculty of philosophy. In addition there were 3,824 male auditors and 1,739 female auditors. In addition to the female auditors there were 2,796 matriculated women in attendance, as against 2,551 during the summer semester of 1911; 2,126 of these were registered under the faculty of philosophy, 600 in medicine, 65 in law and 5 in theology.

Of the 57,398 matriculated students, 52,435 came from Germany, while 4,417 came from other European countries, 338 from America, 175 from Asia, 28 from Africa and 5 from Australia. The largest delegations from European countries hailed from Russia (2,211), Austria (842), Switzerland (341), Roumania (166), Great Britain and Ireland (160), Bulgaria (153) and Greece (98). Berlin attracts by far the largest number of foreign students, namely, 1,536, being followed by Munich (752), Leipzig (697), Halle (320), Heidelberg (215), Königsberg (203), Göttingen (172) and Breslau (160).

R. TOMBO, JR.

THE MEDICAL SCHOOL OF THE UNIVERSITY OF ILLINOIS

THE University of Illinois undertook some years ago in the city of Chicago an experiment in the work of medical education. As it had received no grant from the legislature for the erection of a plant, it leased the buildings, ground and equipment necessary for the use of a medical school from the College of Physicians and Surgeons in the city of Chicago. The rental paid for this property was very reasonable, not exceeding, in fact, the fixed charges of the plant, counting in the interest on the mortgages and bonds and the requirements of the sinking fund. The school has been conducted for some fifteen years under this general arrangement, with details varied from time to time. During that period the school has been greatly improved, and ranks to-day among the good American medical schools.

The University of Illinois, however, has never expended upon this school or its management or in rent for the use of the property, a single dollar from the state appropriations. It has been limited to the use of the fees paid by students. The claim may be fairly made that no better school, conducted on the basis of student fees alone, can be found in the country. The time has come, however, when no medical school can be maintained in accordance with modern standards, whose only support is derived from the payment of fees by students. Recognizing this fact, and unwilling to conduct an inferior school, the university has asked the legislature upon three different occasions for funds to put the school upon a proper basis. The legislature granted at one time the sum of $389,000 for the purpose of providing an adequate plant for the use of the medical school. The governor, however, vetoed this bill. In answer to the last request from the university, the legislature granted (at the 47th Session) for the present biennium, the sum of $60,000 per annum for the equipment, maintenance and extension of the college of medicine of the University of Illinois. This appropriation was lost by the recent decision of the Supreme Court that it was unconstitutional, owing to the fact that the provision in the bill making this appropriation had been amended in the conference committee without having been printed.

The university now renews its request to the General Assembly for an appropriation for the equipment, maintenance and extension of its work in medicine and public health. The College of Physicians and Surgeons, however, has decided not to renew to the university the lease for the use of its present plant in the city of Chicago when it expires on June 30, 1912.

Owing to the fact that there is no other adequate plant in the city of Chicago which can be obtained for the use of a medical school, at a reasonable rental, the board of trustees of the university have been compelled to announce the closing of the medical

work in Chicago. They have decided to develop the medical work already begun at the site of the university in Urbana-Champaign.

To carry on this enterprise a special building is absolutely necessary, since there is no available space to house such work in the buildings now upon the campus, or in those authorized to be erected by the present legislature.

The trustees of the University of Illinois, therefore, have asked the general assembly to appropriate at its special session the sum of $250,000 for the development of its work in public health and medicine at Urbana-Champaign. The greater part of this money will be used for the erection, furnishing and equipment of a medical building. It is proposed to organize those fundamental courses in medicine and public health which should be required by all schools of medicine, and which every physician, no matter what method of practise he may adopt, must be presumed to know, such as physiology, bacteriology, histology, anatomy, pathology and sanitation.

SCIENTIFIC NOTES AND NEWS

At the meeting of the National Academy of Sciences, held in Washington on April 18, new members were elected as follows: R. W. Wood, professor of experimental physics at the Johns Hopkins University; Harry Fielding Reid, professor of geological physics at the Johns Hopkins University; David White, geologist, U. S. Geological Survey; Roland Thaxter, professor of cryptogamic botany at Harvard University; Chas. B. Davenport, director of the Station for Experimental Evolution, Cold Spring Harbor, N. Y.; W. M. Wheeler, professor of economic entomology at Harvard University; John J. Abel, professor of pharmacology at the Johns Hopkins University; S. J. Meltzer, head of the department of physiology and pharmacology of the Rockefeller Institute for Medical Research.

The committee on policy of the American Association for the Advancement of Science held meetings at Washington on April 16 and 17. There were present Mr. Minot, chairman of the committee; Mr. Pickering, president of the association; Mr. Woodward, treasurer; Mr. Howard, permanent secretary, and Messrs. Cattell, Humphreys and Noyes. Various questions were considered, more especially the division of the association into sections, the relation of the sections to the affiliated societies and the program for the Cleveland meeting.

Among the many victims of the terrible disaster to the *Titanic* on April 15, were the following members of the American Association for the Advancement of Science: Mr. Edgar J. Meyer, the well-known mining engineer of New York, who joined the association at the second Baltimore meeting in 1908. Colonel John Jacob Astor who, as is well-known, was greatly interested in mechanical and engineering problems, and who joined at the third New York meeting in 1906. Mr. Frank D. Millet, the well-known artist of Washington, New York and London, who joined at the same meeting as did Colonel Astor. Mr. Millet's interest in science was great and was intensified by his long association with the scientific men in the Cosmos Club of Washington. Dr. Howard, the permanent secretary of the association relates the following anecdote of Mr. Millet: At the time of the meeting of the International Congress of Zoology at Washington in 1907, following the Boston meeting, Dr. Howard was dining one night at the Cosmos Club with Geza Horvath, of the Natural History Museum of Budapest, and G. Severin, of the Natural History Museum of Brussels. As Millet entered the room, he was called over since his knowledge of foreign languages was great and he was much interested in the foreign visitors. He was introduced and at once saluted Horvath in excellent Hungarian; then turning to Severin, instead of speaking to him in French as one naturally would do to a visitor from Brussels, addressed him in Flemish, having, with his artistic eye, noted his apparent descent. Both foreigners were greatly charmed and became at once interested in the man and have always sent greetings to him in their later letters to Dr. Howard.

DR. PAUL G. FREER, director of the United States Government Scientific Bureau in the Philippines and previously professor of chemistry in the University of Michigan, died at Beguio on April 17, at the age of forty-nine years.

THE letters of the late Professor William James are being collected for biographical purposes. Those who have any of his letters can render assistance that will be highly appreciated by addressing Mr. Henry James, Jr., 95 Irving Street, Cambridge, Mass. Casual or brief letters may have an interest or importance not apparent to the person preserving them; and news of the whereabouts of such letters will be gratefully received.

MR. A. D. HALL, F.R.S., has resigned from the directorship of the Rothamsted Experiment Station.

PROFESSSOR H. F. NEWALL, F.R.S., has been elected a member of the Athenæum Club for distinguished eminence in science.

PROFESSOR PAUL WALDEN, of Riga, has been elected an honorary member of the Chemical Society, London.

AT the annual meeting of the Harvey Society, held on April 10, the following officers were elected for 1912–13:

President—Frederic S. Lee.
Vice-president—William H. Park.
Treasurer—Edward K. Dunham.
Secretary—Haven Emerson.
Additional Members of the Executive Committee—S. J. Meltzer, Graham Lusk, W. G. McCallum.

THE *Journal* of the American Medical Association states that a dinner was given to Dr. Ludvig Hektoen at the Chicago Club on April 11 by the faculties of Rush Medical College and the College of Physicians and Surgeons and his former students at these institutions, in honor of the twenty-first anniversary of his entrance into the practise of medicine. Dr. Frank Billings presided. An oil-painting of Dr. Hektoen was presented to him by his friends, the presentation speech being made by Dr. E. R. Le Count. Professor E. O. Jordan and Drs. H. Gideon Wells and James B. Herrick responded to toasts.

PROFESSOR GEORGE GRANT MACCURDY, of Yale University, is installing a hall of European prehistoric anthropology for the American Museum of Natural History, New York.

DR. J. N. ROSE, who has recently been appointed research associate in the Department of Botanical Research of the Carnegie Institution, sailed for Europe on April 17, where he goes to investigate cactus collections in the various botanical gardens of England, France, Italy and Germany. He will be away about two months. His European address will be: Royal Botanic Gardens, Kew, London, England.

PROFESSOR G. FREDERICK WRIGHT, professor emeritus of geology at Oberlin College, president of the Ohio State Archeological and Historical Society, is carrying on a systematic investigation of the Ohio mounds. At present the society is erecting two buildings of importance, one at Columbus, costing $100,000, to serve as a general library and museum, the other at Fremont, costing $40,000, to hold the library of Americana left by the late President Rutherford B. Hayes. Professor Wright has in press a volume on "The Origin and Antiquity of Man," which will appear in July.

ON March 27 Dr. Samuel W. Williston, professor of paleontology in the University of Chicago, delivered an address to the students of the Kansas State Agricultural College, at Manhattan. Coincidently this date was the fortieth anniversary of his graduation from the college. On this date also he matriculated his youngest daughter in the domestic science department of the college. On March 29 Professor Williston delivered a lecture on the "Evolution of Early Vertebrates" to a special meeting of the College Science Club.

AT the annual meeting of the Michigan Academy of Science, held at Ann Arbor March 27–29, the principal address was delivered by Professor Albert A. Michelson, of the University of Chicago. The subject of the address, which was illustrated, was "Iridescent Colors in Birds and Insects." Professor E. C. Case, of the University of Michigan, was elected president of the academy.

The lecture on "North American Deserts" given by Dr. D. T. MacDougal before the Royal Geographical Society of London in December was repeated by him on request before the four branches of the Royal Scottish Geographical Society in Dundee, Aberdeen, Edinburgh and Glasgow during the first week in April.

Professor Frederic S. Lee, of Columbia University, lectured before the International Y. M. C. A. Training School at Springfield, Massachusetts, on April 12, on "Some Aspects of Muscular Action."

Dr. Frank D. Kern, of Purdue University, gave an illustrated lecture on April 15 before the local Academy of Agricultural Science on the "Floral and Scenic Features of Colorado." A number of seasons spent in studying the plant rusts of that state supplied the basis for the lecture.

Professor Francis E. Lloyd has recently lectured before the botanical seminar of the Johns Hopkins University on some of his recent work on the tannin content of the acorn (*Quercus laurifolia*). Somewhat later he lectured also before the students of the department of biology, Teachers College, Columbia University, on recent advances in the teaching of botany.

Under the auspices of the department of geology two lectures by Professor Isaiah Bowman, of Yale University, were on April 4th delivered at the University of Michigan. The subjects of these lectures were: "The Mountains and Deserts of Bolivia" and "Geographical Explorations in the Peruvian Andes."

Dr. Irving A. Field, special investigator for the U. S. Bureau of Fisheries, lectured at Trinity College on the evening of April 18, on the subject "Utilization of Hitherto Unused Marine Organisms as Food."

Dr. Marie Stopes has given a course of ten lectures on the general and geological aspects of paleobotany at University College, London. It was the first course on this aspect of the subject to be given in London.

On the evening of March 29, the Pennsylvania Chapter of the Society of the Sigma Xi was addressed by Professor William J. Gies, College of Physicians and Surgeons, Columbia University, on the subject, "Chemistry in the Service of Biology." Professor Gies reviewed the history of biological chemistry, explained the problems now being attacked by biological chemists and outlined the problems still open for investigation.

At the Washington birthday celebration of the University of Pennsylvania it was announced that a donation had been received to endow "The Leidy Memorial Lecture in Science" in memory of the late Professor Joseph Leidy.

We learn from *Nature* that the Essex Field Club has recently appointed a committee for the purpose of raising a small fund to put in order the tombs of John Ray and Benjamin Allen (which stand adjacent to one another in the churchyard at Black Notley, but have been allowed to fall into disrepair), and to erect at Braintree a memorial to Samuel Dale, of that town, to whom no memorial exists. These three naturalists were friends and contemporaries, living at Braintree or in its immediate vicinity in the closing years of the seventeenth century and the opening years of the eighteenth.

Dr. Edward Divers, F.R.S., emeritus professor of chemistry in the University of Tokyo, died on March 8, aged seventy-five years.

Dr. A. Pacinotti, professor of physics at Pisa, has died at the age of seventy-one years.

The U. S. Civil Service Commission announces an examination on May 8, to fill vacancies as they may occur in the position of scientist in soil survey, at a salary of $1,600 per annum, in the Department of Agriculture, for duty in the field.

The Columbia Chapter of the honorary Society of Sigma Xi held its annual initiation and banquet on April 4. At the initiation ceremonies, the 36 new members elected to the society were welcomed by the president of the chapter, Professor George F. Sever.

He explained the origin and purpose of the society, and introduced Professor Henry S. Munroe who spoke on the "Significance of Sigma Xi." At the banquet which followed at the university, representatives were present from the chapters at Cornell, Yale and Pennsylvania.

MR. C. W. LENG has put his valuable collection of "long horned" beetles at the disposal of the American Museum of Natural History for use in filling gaps in its collections. This means a gift of some 870 specimens covering nearly 300 species not hitherto acquired. Mr. John A. Grossbeck, who has been specializing for some time on the Geometridæ, has given to the museum his entire collection of these moths in addition to the series previously donated.

WE learn from *Nature* that the sixty-fifth annual general meeting of the Paleontographical Society was held in the Geological Society's rooms at Burlington House on March 22, Dr. Henry Woodward, F.R.S., president, in the chair. The annual report referred to the completion of the monograph of English Chalk fishes, and of the second volume of that of Pleistocene mammalia. It also acknowledged the help of the Carnegie Trust for the universities of Scotland in providing the plates for another instalment of Dr. Traquair's monograph of Carboniferous palæoniscid fishes. A special effort had been made to complete works in progress before beginning new undertakings. Miss Margaret C. Crosfield, Mr. George Barrow, Mr. H. R. Knipe and Professor W. W. Watts were elected new members of council. Dr. Henry Woodward, Dr. George J. Hinde and Dr. A. Smith Woodward were reelected president, treasurer and secretary respectively.

THE natural history library of the University of Illinois has been enriched by the addition of a set of Flora Braziliensis, in forty folio volumes and costing $1,500. The set is written in Latin and is said to be the fourth obtained by American libraries, others being at Harvard, Columbia and the Shaw Botanical Gardens.

IT is stated in *Nature* that the whole of the famous collection formed by the Rev. Canon Norman, F.R.S., consisting of North Atlantic and Arctic invertebrates other than insects, arachnids and myriopods, has now become the property of the Natural History Museum, the fourth and last instalment having been received recently at Cromwell Road. Of Mollusca there were specimens in 7,114 glass-topped boxes, of Crustacea there were 7,376 bottles and tubes containing specimens, and there were, in addition, 5,544 microscopical slides. The Polyzoa were contained in 1,063 glass-topped boxes, while there were 497 spirit specimens and 185 microscopical slides. The "lower invertebrata" were numerously represented in the earlier instalments.

UNIVERSITY AND EDUCATIONAL NEWS

THE University of Chicago has established a system of retiring allowances for professors or their widows. A fund of $2,500,000 taken from the $10,000,000 Rockefeller gift of 1910 has been set aside for this purpose. This pension system will grant to men who have attained the rank of assistant professor or higher, and who have reached the age of sixty-five, and have served fifteen years or more in the institution, 40 per cent. of their salary, and an additional 2 per cent. for each year's service over fifteen. The plan also provides that at the age of seventy a man shall be retired unless the board of trustees specially continues his services. The widow of any professor entitled to the retiring allowance will receive one half the amount due him, provided she had been his wife for ten years.

AT Princeton University a fund of $5,000 has been established by Mr. Albert Plaut, of New York, for the purpose of encouraging the study of chemistry, especially by securing distinguished chemists to address the Chemical Club; and the Louis Clark Vanuxem foundation has been established by a bequest of $25,000, under the will of Mr. Vanuxem, for the support of a series of lectures at Princeton annually, at least one half of which must be

upon subjects of current scientific interest. It should have been stated in the last issue of Science that the gift of $300,000 to Princeton University from Mr. W. C. Procter for the establishment of fellowships was part of his gift of $500,000, the balance having been used for the construction of a memorial dining hall in the Graduate College.

Mrs. H. M. Bernard, of London, has arranged with Professor Kellogg who is at present in London, to establish a small scholarship in the department of entomology at Stanford, to aid an advanced student for two years in an investigation of some problem in insect evolution. The scholarship will yield one hundred dollars a year besides an additional sum to pay all laboratory fees. Mrs. Bernard is the widow of the English biologist Henry M. Bernard, a student of Ernst Haeckel, at Jena, an authority on the corals and an independent investigator of evolution problems. Mrs. Bernard has recently edited and published many of her husband's notes in a book called "Some Neglected Factors in Evolution" (Putnam's). She has already established an evolution scholarship in the University of London, and expects to found others in three or four American universities.

The library of the department of botany, Brown University, has received a gift of 150 volumes of rare botanical books, valued at $2,000, in memory of the late Edward P. Taft, class of '54.

Governor Dix has signed the Harte bill providing for the establishment of a New York State School of Agriculture on Long Island and appropriating $50,000 for that purpose. He says in a memorandum that plans should be formed and put into effect for the training of qualified agricultural teachers in one or more of the state normal schools and that an effort should also be made toward the introduction in the public high schools of at least the elementary study of agriculture.

Professor Henry B. Fine has resigned the deanship of the faculty of Princeton University but continues as dean of the departments of science and as Dod professor of mathematics. He has been granted a leave of absence for the next academic year which he will spend in Europe. Dr. William F. Magie, Henry professor of physics, has been elected dean of the faculty to succeed Professor Fine.

Dr. Alfred M. Tozzer has been appointed assistant professor of anthropology at Harvard University.

Dr. Gilbert N. Lewis, research professor of chemistry in the Massachusetts Institute of Technology, has been appointed professor of physical chemistry in the University of California, succeeding the late Willard B. Rising. Dr. H. W. Morse, now of Harvard University, becomes lecturer in chemistry. In the same institution Dr. S. J. Holmes, of the University of Wisconsin, has been appointed associate professor of zoology. The last appointment is made to fill the vacancy caused by the removal of Professor H. B. Torrey to Reed College.

DISCUSSION AND CORRESPONDENCE

PHENOTYPES, GENOTYPES AND GENS

While there should be no objection to weekly revisions of the vocabulary of genetics, if any useful purpose is served, some readers of Science may share in the belief that special terms can have little practical value unless they continue to bear the same or closely related meanings. The word phenotype, for example, seems to have been employed by Professor Johannsen as a statistical term, for a purpose essentially different from that illustrated in Dr. Shull's recent paper, in Science of February 2, 1912, p. 182. Dr. Shull assures us of Professor Johannsen's authority for the new version of phenotype, but this does not destroy the historical interest of previous revelations.

To show the distinction that phenotype once conveyed, a free translation of Johannsen's most direct statement may be given:

> Thus we recognize that the "type" in the Queteletian sense is merely a superficial appearance which may be deceptive; only through further investigation can it be determined whether one or many biologically different types are present.

Therefore it would be proper to designate the statistically prominent type as an apparent type (*Erscheinungstypus*), or, more briefly and directly, a phenotype (*Phaenotypus*). Such phenotypes are in themselves measurable realities; something that can be observed as typical; that is, the centers among series of variations, around which the variants are grouped. The word phenotype serves only to make the necessary mental reservation that from the appearance alone no further conclusion can be drawn. A given phenotype may be an expression of biological unity (*Ausdruck einer biologischen Einheit*), but it does not at all need to be. Indeed, this is not true, in a great majority of cases, of the phenotypes found in nature by statistical investigations of variations.[1]

Of course it would be presumptuous to assume that any translation would convey the exact meaning of such a passage, but at least it can be seen that phenotype was being used by Johannsen as a concrete collective term, and not merely as an abstract conception, as Shull has supposed:

"Phenotype" and "genotype," when both are rightly used, *are contrasted terms,* both being *abstractions* referring to the *type* to which an individual or group of individuals belongs, and *not to the group of individuals* belonging to that type. To illustrate the use of "phenotype" in its correct sense, reference may be made to the F_2 of a Mendelian hybrid.[2]

When the phenotype idea was brought later on into direct contrast with the genotype idea, the two were compared as abstractions, but this conceptual refinement was for purposes of explanation and did not necessarily supplant the more concrete application of phenotype previously made. Shull need not apologize for himself or for Jennings on account of having used phenotype in a concrete sense. It may be that the first use of the term, as restricted to the statistically prominent center of the group, was too narrow for convenience, but any group that has been found to show a statistical unity could be described at least as phenotypic.

[1] Johannsen, W., "Elemente der Exacten Erblickertslehre," p. 123.

[2] Shull, G. H., "'Phenotype' and 'Clone,'" SCIENCE, N. S., Vol. XXXV., February 2, 1912, p. 182.

That Johannsen did not contemplate the employment of "genotype" in any such concrete sense as phenotype seems plain from the statement that accompanies his definition:

Very obvious phenotypical differences may be shown where no genotypical difference is present; and there are also cases where with genotypical diversity the phenotypes are equal. Just for this reason it is of the greatest importance to separate clearly the conception phenotype or apparent type (*Erscheinungstypus*) from the conception genotype or germ-type (*Anlagetypus*), as one might say. With this latter conception, to be sure, we shall not be able to work (*nicht operiren können*) —a genotype does not make its appearance in pure form (*tritt eben nich rein in die Erscheinung*); but the derived concept of genotypical difference will be of use in manifold ways.

Phenotypes, as we learned from the previous quotation, are found in nature, but genotypes are not. To the unregenerate reader Johannsen's genotype appears to be nothing more than an unframed conception of a germinal or genetic constitution, considered as something apart from the external manifestation of the characters. It is an indirect and complicated substitute for the old distinction between latent and patent characters, between transmission and expression.

To replace the word genotype because it was preoccupied in taxonomic biology may not seem so necessary if it be considered merely as the name of an abstract conception with no real existence that needs to be discussed in biological literature. But that geneticists should wish to keep the word in active use as a major term after its previous history has been pointed out is only one more way of showing disregard for the taxonomic framework of biology.

The adjective use of genotype is hardly more fortunate than the substantive application. Why we should say genotypical differences instead of genetic differences or germinal differences is not obvious, but perhaps the longer word means more to geneticists. If the object was to keep closer to the idea of a germinal constitution made up of separate units or gens, the meaning could have been

conveyed more effectively by speaking of *genic* differences than by adding extra syllables. The "type" part of Johannsen's words has served only to confuse the issues, as in the passage where Shull says that phenotypes and genotypes are abstractions relating to types but not to groups. How can there be typical differences, in any biological sense, unless groups are compared? The fact seems to be that Johannsen was not using the word type in accord with biological traditions, but in a loose metaphysical way that renders the terms more abstract instead of more concrete.

There should have been no difficulty in finding suitables names for the two classes of Mendelian hybrids that Shull has pointed out, instead of allowing them to become confused with Johannsen's genotypes and phenotypes. As the so-called genotypes are supposed to have the same gens, they could be described as isogenic hybrids or isogens. Any group treated as having biological unity may be called an isogen. Johannsen approached the idea of biological unity in the passage explaining the use of phenotype, but did not provide a name for such groups except indirectly through the genotype concept.

The hybrids that have different germinal constitutions, and yet look alike, could be described as isophanic hybrids or isophans. They have the same dominant characters, but this does not involve any complete statistical or phenotypic unity. The groups are formed with reference to alternative, Mendelian characters, instead of on the basis of statistical measurements of continuous variations. As Johannsen pointed out, even genotypical unity does not preclude phenotypical differences.

Pluralizing the word gen is another difficulty encountered by geneticists. Johannsen used the term mostly in its German plural form, *Gene*. Our writers have added another letter making a double plural, "genes," something like "memorandas."

Johannsen proposed gen as a simplification of Darwin's term pangen, to avoid the implications of Darwin's theory of pangenesis:

> Instead therefore of pangen (*das Pangen*) and pangens (*die Pangene*), we shall simply say gen (*das Gen*) and gens (*die Gene*).

Along with this word *gen*, to represent an invisible rudiment or transmitted germ of a character, it will be useful to have a corresponding term, *phan*, to represent an external manifestation or expression of a character. To be able to refer to the external expression or phanic relations of characters is quite as important as to discuss them from the standpoint of theories of transmission. From these two roots it will be easy to develop a simple and appropriate terminology for many of the facts of heredity.

O. F. Cook

Washington, D. C.,
February 24, 1912

Cross Cutting and Retrograding of Stream-Beds

In the October (1911) number of the *American Journal of Science*, I read with interest an article by Mr. John Lyon Rich on "Recent Stream Trenching in the Semi-arid Portion of Southwestern New Mexico, a Result of Removal of Vegetation Cover," on which I have ever since intended making brief comment, because it seemed to me Mr. Rich presented only one phase of the subject. While the stated factor, "removal of vegetation cover," may in some localities, accelerate the retrograding (trenching) of stream-beds, it is not, in my opinion, the cause of retrograding. I noted the same characteristics (and others probably also noted) years ago in places where there were no cattle and never had been any.

The "trenching," Mr. Rich says, "is still in progress," which is true, for it has always been and always will be, in progress, cattle or no cattle, vegetation or no vegetation, not only in semi-arid regions but everywhere. There are differences in degree and rate—that is all—and in arid regions the rate is conspicuous.

There are two forces at work wherever water runs or ice flows, which, so far as I know, have not been sufficiently defined up to the present. They are *cross-cutting* and *retro-*

grading of stream-beds. They are close companions and they are among the chief causes of degradation in any region, being more noticeable in mountainous semi-arid regions because inequalities of stream flow are greater in such regions.

Every water course (or glacier course) is subject to cross-cutting, on a greater or smaller scale according to conditions. In semi-arid lands it is often violent.

Take a stream flowing in a semi-arid region over the surface of a sedimentary deposit of say 20 feet in depth. This stream bed terminates in some other stream bed which may be dry most of the time, the water of the first evaporating or seeping away before the junction is reached. For some reason this master-stream corrodes its bed more rapidly than the tributary—by sudden flood, perhaps, in which the tributary does not share. The tributary stream bed is cut away at the junction, leaving it high above the bed of the master-stream —the water, if there is any at this point, cascades. The tributary enters by what has been termed a hanging-valley. The process of retrograding then begins in the tributary stream-bed. It is a process of corrosion by undercutting. It may be slow or fast, depending on many conditions. In arid and semi-arid regions, banks of dry earth often remain vertical for years. This is partly because the surface behind the wall (as pointed out by Stanton in his investigation of the landslides on the Canadian Pacific Railway) becomes impervious to water and, like a roof, prevents the earth mass from becoming saturated. Even when chunks of this earth fall beside a stream they do not readily disintegrate unless completely submerged, because the clay forms on their surface an impervious coating. I have seen earth-cliffs 30 to 40 feet high with all the characteristics of a rock-cliff erosion. The run-off is quick. Steady rains are infrequent. The earth mass can not become saturated. But given an abnormally steady and long-continued rainfall, in combination with a "cloud-burst," at the headwaters, and all is changed with startling rapidity. It is dramatic. The tributary flood undercuts its precipice steadily and mass upon mass of the earth drops into the flood to dissolve. The precipice travels up stream.

The tributary stream-bed is immediately placed on a par with its master. When the storm is over the precipice of earth if found at all is found miles towards headwaters. The former stream instead of flowing on the surface amidst verdure and willows and cottonwoods, now glides at the bottom of a desolate and barren earth canyon.

In the retrograding it has cross-cut the mouths of other stream-beds, where in time, the operation described is repeated over and over, as the country is gradually lowered by these forces.

There have been many excellent examples of cross-cutting and of violent retrograding, two of which I may mention. In the 60's of the last century one occurred at the little Mormon settlement of Santa Clara in south Utah. In a single night the stream was metamorphosed. At Kanab, south Utah, a similar example took place about 1900. In an astonishingly brief time the Kanab creek meandering amongst willows and vegetation was transformed into a waste for miles of its course. The channels through which the Colorado River broke into the Imperial Valley exhibited retrograding in its violent form and excellent photographs were made at the time.

In the Mukuntoweap Valley in southern Utah cross cutting and retrograding in rock may be studied. Some small valleys that were cross-cut ages ago remain almost unaltered. They hang 1,000 feet above the master-stream. The explanation seems to be that during the Glacial Epoch the high plateaus at the head waters of the Virgin river were heavily piled with snow and ice which, melting in the summers, carried on rapidly the work of corrosion in the main streams which had sources in the very high lands, while the shorter stream-beds with lower sources were even then arid and were left behind, having no power of retrograding to keep level with master streams. In other words the corrosion of the master-streams ran away from the erosion of the drier valleys, leaving the latter hanging

in the air. The process is the same as when earth is concerned.

F. S. Dellenbaugh

226 W. 78th St.,
New York,
March 29, 1912

REPORTED DISCOVERY OF RADIUM IN NORTHERN ARKANSAS

In this day, new results of scientific work make such rapid appearance that the public in general are very credulous about reported discoveries however unreasonable they may appear, and even scientists are cautious about expressing adverse opinions concerning such, without having carefully investigated them. Apropos of this, a short article that some weeks ago appeared in a St. Louis paper, reporting an alleged discovery of radium in northern Arkansas and naming the writer as authority for its existence, has been somewhat widely copied by the press, and has brought numerous letters to the writer from different parts of the country from New York to California. Among these have been letters from scientists and those engaged in commercial work. The foundation for the report is as follows:

In the latter part of February there came to the writer's office, then at the University of Arkansas, a Mr. Leib, of Bentonville, that state, who brought a cigar box of earthy material which he said came from a cave near his home. It was just such material as might come from any limestone cave. With the box was a photograph which Mr. Leib said had been made by exposing the box containing the material before a camera, for several hours, in an absolutely dark room. The picture was of about the distinctness of an ordinary X-ray photograph. It plainly showed the box, the string about it and the knots in the string.

Mr. Leib was told by both Professor A. A. Steel, of the University of Arkansas, and myself that while the photograph was interesting, careful investigation was necessary before it could be stated that the substance contains any radium or other radio-active material. For this purpose he was advised to send some of it to Professor B. B. Boltwood, of Yale University.

Such is the basis of a newspaper story that seems to have attracted a good deal of attention.

A. H. Purdue

State Geological Survey,
Nashville, Tenn.,
April 17, 1912

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

To the Editor of Science: It is generally agreed that the recent Washington meeting of the American Association for the Advancement of Science and its affiliated societies was one of the most enjoyable, helpful and inspiring meetings ever held in this country. The attendance was large, the programs well filled, the discussions earnest and the efforts of the local committees fully successful in providing ample means for social intercourse without too much distraction from the work of the meeting.

Nevertheless, that meeting probably marks the parting of the ways, and it behooves all of us who have been and still are loyal to the American Association for the Advancement of Science to give earnest consideration to the question of the future policy of that union of scientific workers which has in the past done so much to deserve its title.

Two of the fundamental principles of the association are: first, by means of migratory meetings to arouse interest in scientific matters in different sections of the country; second, to bring together workers in all branches of science, for mutual acquaintance and for the development of broader view-points than is possible from too close absorption in one's own special line.

These ideals could be and have been well realized in the past when the average attendance on such meetings was not too large for the hotel accommodations of most of our cities and when it was usually possible to have meetings of various sections in one building, thus enabling closely related sections to meet in adjacent rooms.

But that day has passed. Organization among scientific workers has increased at a tremendous pace during the past few years, largely through the energy of the officers of the organizations of special branches of science. The growth from two thousand to almost six thousand in the membership of the American Chemical Society within the past four years is only typical of the relative activity in other societies.

With such an increase in organization membership it has now become a physical impossibility to longer realize the old ideals of the American Association for the Advancement of Science, and so we hear more and more of withdrawal movements. The example of the zoologists, naturalists and anatomists, during the last convocation week is going to be more and more followed by other societies.

Does this mean the dismemberment of the American Association for the Advancement of Science, the giving up of the opportunity to come in touch with fellow workers in allied sciences, the loss of a national association of organized science? Truly this would be a calamity.

Can such a calamity be avoided?

In the hope of at least provoking discussion, the following suggestions are submitted, in full realization of their imperfections, but nevertheless, as based upon an honest effort to look the situation squarely in the face.

First. Let the American Association for the Advancement of Science lend all of its aid and sympathy to the development of the affiliated societies.

Second. Let the American Association for the Advancement of Science give up its present annual meetings and instead hold triennial or quadrennial meetings.

Third. Let the affiliated societies in turn give up their regular meetings at the time of the American Association for the Advancement of Science meetings and lend all of their influence towards making these meetings great national gatherings of scientists.

Fourth. Let the migratory meetings of the affiliated societies serve the purpose of arousing local public interest in scientific work.

Fifth. Let the meetings of the American Association for the Advancement of Science be held in the national capital, at a time when Congress is not in session and hotel accommodations consequently ample.

If such a policy could be agreed upon by all, the American Association for the Advancement of Science could well afford to give up its charge of an initiation fee from all who are members of affiliated societies. Further, in view of the decreased administrative expense and largely increased membership the present annual dues might possibly be still further reduced.

Such truly national gatherings of scientific workers would be inspiring to all of us, and would make a national impress, as the best conditions would there prevail for the formulation of scientific policies of nation-wide importance.

To carry out the above plan no very great practical difficulties would have to be overcome. The changes are not radical, but evolutionary in character. It is hoped that the suggestions may be of some service.

CHAS. H. HERTY
UNIVERSITY OF NORTH CAROLINA

SCIENTIFIC BOOKS

Bacteria in Relation to Plant Diseases. By ERWIN F. SMITH, in charge of laboratory of plant pathology, Bureau of Plant Industry, U. S. Department of Agriculture. Volume II., History, General Considerations, Vascular Diseases, Washington, D. C. Published by the Carnegie Institution of Washington. 1911. Pp. viii + 368. Quarto. Publication No. 27, Vol. two.

Somewhat more than six years ago the writer of this notice had the pleasure of publishing a note (SCIENCE, Nov. 24, 1905) in regard to the first volume of this work, and there expressed the hope that the publication of the second volume would "not be long delayed." But good and sufficient reasons for the delay are given in the introduction to this volume, where we are told that it is "based in great part on data obtained as the result of a

multitude of experiments made by the writer and his assistants" and that "it has often happened that the ink on some chapters would scarcely be dry before the results obtained from new experiments would require some part of it to be rewritten." We are further told that in this way some chapters were "rewritten a dozen times, in whole or great part." These quotations will serve also to give some idea of the method of science, and of the infinite pains which must be taken before final results are attained.

As indicated by the title of this volume, it deals with the history of the subject, that is, with the successive investigations of workers in this field of science. Some of the pronouncements of the earlier pathologists now make "mighty interesting reading," as shown by the quotations which are liberally given on pages 9 to 20. Then follow nearly two hundred pages of "general considerations" in which are discussed such questions as "the supposed normal occurrence of bacteria in plants" (which is decided in the negative); "bacteria on the surface of plants"; "parasitism"; "inception and progress of the disease"; "reaction of the plant"; "symbiosis," etc. The remainder of the book (about 150 pages) is devoted to "Vascular Diseases," that is, the diseases which have to do with the vessels of plants.

Three vascular diseases are fully discussed, namely, the "Wilt of Cucurbits," the "Black Rot of Cruciferous Plants" and the "Yellow Disease of Hyacinths." These are severally due to the invasion of the tissues by *Bacillus tracheiphilus* Smith, *Bacterium campestre* (Pammel) Smith, and *Bacterium hyacinthi* Wakker. As one reads the pages of descriptions he is impressed with the thoroughness with which the work upon which they are based was done. At every step one sees the results of the most painstaking investigation, much of which extended through many years. And with it there grows the feeling that here at last we have contributions to plant pathology that rest upon solid foundations and from which guesses and inferences have been wholly omitted.

In the introduction (page 4) we are given a convenient grouping of the diseases of plants due to bacteria, viz.: (1) The vascular diseases, (2) the parenchyma diseases without hyperplasia and (3) cankers, tubercles and tumors in which there is a more or less distinct hyperplasia. It will appear from this that the author has treated but one type or group of diseases, and from this we may infer that this volume is to be followed by one or more others, although no hint is given us by the author as to his intentions. It is to be hoped that Volume III. will appear in due time and that if this be not enough still others may follow. We can not help wishing that the plant diseases due to the fungi might find an investigator who would do for them what Dr. Smith is doing for those due to bacteria.

Charles E. Bessey
The University of Nebraska

Corrosion of Iron and Steel. By J. Newton Friend, Ph.D. Longmans Green & Co. 1911. Pp. 300; 62 figures.

Of the many references to the literature of the subject cited by the author, none is more interesting than the following from Pliny written some 2,000 years ago. In his "Natural History" Pliny writes "there is a kind of hallowing iron within the city called Zeugma, seated upon the Euphrates, wherewith King Alexander the Great some time bound and strengthened the bridge over the river there; the links whereof, as many as have been repaired and made new since, do gather rust, whereas the rest of the first making be all free therefrom." Evidently at this very early date the observation had been made, not only that iron rusts, but that different pieces may rust at different rates. The general subject has received so much attention from men in widely differing fields, and their publications have appeared in so great a number of places, that there existed a need for a work which would thoroughly digest this literature and gather together that portion which seemed sufficiently reliable to be of service to the investigators of the present. This task, which has not been an easy one, Dr.

Friend has accomplished in a thoroughly satisfactory way in the present volume.

The action of air and water and also steam upon iron is discussed at length, together with the various theories which have been advanced to explain corrosion. The author's experiments to prove that a trace of carbonic acid, however minute, is essential in order that rusting will take place, are of but academic interest, since such conditions can never be duplicated except with the refinements of a laboratory; and his conclusion that the electrolytic theory of iron is untenable is not warranted. In fact, the so-called acid theory which the author vigorously defends is none other than the electrolytic theory, where the assumption is made that the hydrogen ion concentration in pure water is not great enough to produce a speed of reaction sufficiently high to make the rusting of iron at low temperatures obvious; while by the introduction of carbonic acid the concentration of the hydrogen ions is increased to such a point that iron will pass into solution rapidly enough to appear as rust. The book in many places suffers somewhat by the author's unwillingness to make use of the conceptions introduced by the electrolytic theory which, were they used, would simplify the treatment.

The chapters on the factors influencing the rate of corrosion exposed to natural forces, the action of acids and single salts and other electrolytes upon iron are most complete and give the reader a clear idea of the existing knowledge of this phase of the subject. Chapter XII. is devoted to the passive state of iron, and while it seems to contain all that we know upon the subject it emphasizes the fact that our present knowledge is far from giving us a satisfactory explanation for this peculiar phenomenon. The later chapters deal comprehensively with the influence of chemical composition upon the durability of iron, electrical and galvanic action, and the relative rate of corrosion of iron and steel.

It is a matter of regret that the author has been misled, as have also the reviewer and others, by giving credence to statements and data supplied by the American Rolling Mill Co., of Middletown, Ohio, which he publishes on pages 114, 250, 276 and 251, regarding the purity of this firm's products. For example, the material said to have the analysis published on page 114, as containing 99.954 per cent. iron, and which on page 276 is proposed as a standard for *pure iron* on which to base a corrosion factor, was later found by the author himself, much to his surprise, to contain .172 per cent. copper.

The book constitutes a distinct and valuable contribution to the literature on the subject of corrosion, and will prove of interest to the general reader as well as of great service to those particularly interested in this field.

WILLIAM H. WALKER

Principles of Electrical Engineering. By HAROLD PENDER, Professor of Theoretical and Applied Electricity in the Massachusetts Institute of Technology. New York, McGraw-Hill Book Company. 1911. Pp. xviii + 438.

Convinced that the principles of electrical engineering are the principles of physics—a fact too frequently overlooked—and recognizing that a clear conception of these principles is essential for a proper und rstanding of the complicated reactions that take place in electric machinery and transmission circuits, the author of this book in an admirable manner deals successively with the more important phenomena of electricity and magnetism, continuous and alternating currents. On the whole the treatment is satisfying and thorough. The mathematical discussions are adequate but, being merely a means to an end, are not too extensive. Descriptions of machinery and apparatus—even of the transformer—are entirely omitted, the book having the same relation to electrical engineering as a first-class treatise on mechanics has to mechanical engineering. There has long been a demand for a comprehensive and thorough treatise of this kind. It has been customary either to shirk the matter and use descriptive texts, or to use separate texts, on the elements of electricity and magnetism, electrostatics, alternating currents, etc.

Technical schools should make every endeavor to develop men who are capable of advancing the art and who are not mere followers of "best practise," an end that may be secured by the more general use of books of this type. The reviewer agrees thoroughly with the author's point of view and in general with his methods; minor criticisms seem unnecessary. The lack of reference to the work of others is noticed. The abbreviation of "logarithm" to *ln,* in the same font as is used for expressing quantities, seems undesirable; thus, *ln i* is not recognized at once as the familiar log *i*. Some statements in regard to units might well be qualified by the insertion of "sometimes used" or of some similar phrase; since, for example, no electrical congress has recommended the "gilbert" or the "abvolt," objection may be taken to the statements that the C.G.S. unit of magnetic potential difference *is* the "gilbert" (p. 92) and the C.G.S. unit of electric potential difference *is* the "abvolt." In general, however, the phraseology is precise.

Frederick Bedell

Electro-Analysis. By Edgar F. Smith, Professor of Chemisty and Provost, University of Pennsylvania. Fifth edition. Philadelphia, P. Blakiston's Son & Co. 1911. 12mo. 332 pages, 46 illustrations, flexible leather binding. Price ?

The revised and enlarged edition of this attractive and useful book contains, as new material, the essentials of all that has appeared upon electro-analysis during the past four years. The author particularly emphasizes his continued success in using the mercury cup and his conviction of its wide utility in electrolytic analysis. To those unfamiliar with the previous editions it may be said that the work contains practically everything of value extant in electro-analysis, presented in most attractive and available form, and that possibly half of the whole subject matter is the direct work of Dr. Smith and his students and assistants. It is quite pertinent to call attention to the fact that many of the methods of exact quantitative separation and precipitation used in electro-analysis are borrowed from and constitute modifications of industrially applied processes; this is especially true of the mercury cathode methods; reciprocally it is even still more evident that many valuable industrial processes have evolved from the laboratory investigations and the exact manipulations of electro-analysis, and yet more are waiting to be developed. This reciprocal excitation of laboratory and works is a particularly gratifying object lesson in modern scientific and industrial interdependence. We therefore recommend the book most heartily, not only to chemical analysts, but just as strongly to technical electrochemists studying the problems of electrochemistry, both in the research laboratory and in the works.

Joseph W. Richards

THE HABITS OF FLIES OF THE GENUS CORDYLOBIA, PARASITIC ON MAN IN AFRICA

In Africa the larvæ of certain flies (*Cordylobia*) of the family Muscidæ are parasitic under the skin of man and other warm-blooded animals in the same manner as are the larvæ of many of the flies usually grouped together as Œstridæ. Until recently the manner in which *Cordylobia* infected its host was unknown. Independent results have now thrown light on this question.

Monsieur E. Roubaud, in the *Comptes Rendus Hebdomadaires des Séances de l'Academie des Sciences* of the 23d of October, 1911. presents the results of his studies of the "Ver du Cayor," *Cordylobia anthropophaga* Blanchard. The larva is found under the skin of man and domestic animals. In the Œstridæ, with the forms found in tumors under the skin, two distinct modes of infection of the host are known. In both cases the eggs of the fly are laid upon the host. In one case the newly hatched larvæ penetrate at once to their proper habitat, but in the other the eggs are swallowed by the host and the newly hatched larvæ bury themselves in the tissues of the œsophagus and only reach the surface after protracted wanderings within the body of

their host. With these facts in mind M. Roubaud experimented upon *Cordylobia*. He found that eggs placed directly upon the skin do not result in the infection of the animals. In the same way his experiments indicated that where eggs were swallowed by animals no infection followed. His experiments with a third method proved successful. Fifteen small larvæ were taken immediately upon the hatching of the eggs and were placed upon a light layer of sand in a large vessel. A guinea pig was shut up in the vessel for twenty hours and then taken out and placed in a wire cage. The result was that three days afterwards six tumors were found on the under side of the body, upon the muzzle and near the anus, each one containing a rapidly developing larva. His experiments indicate, therefore, that infestation is accomplished exclusively by the direct and active penetration of young larvæ hatched elsewhere. He followed day by day the evolution of the larva and describes the successive stages, which occupy only a week. He believes that Europeans are only accidental hosts of this parasite, but that with the natives who sleep on the ground the infection is naturally much more easy. The investigations were made in the laboratory at Bamako.

Of equal interest are the observations of Herbert von Pelser-Berensberg ("Societas entomologica," Vol. 26, p. 34, July 29, 1911) on *Cordylobia rodhaini* Gedoelst. It had been supposed that uncleanly habits led to infection, but it was found that those persons who bathed most frequently were most subject to infection and the inference was that the eggs were laid upon the exposed body. Keeping eggs under a watch-glass bound to his arm, von Pelser-Berensberg found that the newly hatched larvæ, while they gnawed the skin, did not succeed in penetrating. Later he solved the problem by direct observation. While bathing he noticed that certain flies were attracted to the clothing which he had spread out on bushes, in the sun, to dry off the perspiration. He found that these flies were *Cordylobia* and that they had glued about twenty eggs to his underclothing. As an experiment he continued to wear the clothing. Examination at the end of the first day showed that the eggs were intact, but on the second day they had hatched. Search with a lens upon the skin revealed some minute red spots and beneath these were the young larvæ, about .5 mm. long.

FREDERICK KNAB

THE NATIONAL ACADEMY OF SCIENCES

THE scientific program of the National Academy of Sciences, which met at Washington on April 16, 17 and 18, was as follows:

George E. Hale: "The New Tower Telescope of the Mount Wilson Solar Observatory."

W. W. Campbell: "Radial Velocities of 213 Brighter Class A Stars." "Radial Velocities of 190 Brighter Class F Stars." "Some Characteristics of Stellar Motions."

W. J. Humphreys (introduced by Cleveland Abbe): "Holes in the Air."

R. A. Harper: "The Organization of the Cell Colony in *Pediastrum*." (By title.)

D. H. Campbell: "On the Morphology and Systematic Position of *Calycularia radiculosa* (Sande Lac) Stephens." (By title.)

William Trelease: "A Revision of *Phoradendron*."

H. F. Osborn: "Biological Foundation of Bergson's 'Creative Evolution.'" (By title.)

E. S. Morse: "Biographical Memoir of C. O. Whitman." (By title.)

G. L. Goodale: "Biographical Memoir of Alexander Agassiz." (By title.)

By invitation of the Council—

Harvey Cushing: "Some Observations on the Functions of the Pituitary Body."

Jacques Loeb: "The Activation of the Animal Egg from the Physico-chemical Standpoint." (By title.)

J. A. Holmes: "The National Phases of the Mining Industry."

C. G. Abbot: "The Solar Radiation."

ANNUAL MEETING OF THE AMERICAN FEDERATION OF TEACHERS OF THE MATHEMATICAL AND THE NATURAL SCIENCES

THE American Federation of Teachers of the Mathematical and the Natural Sciences held its annual meeting at the New Willard Hotel in Washington on December 27.

The associations composing the federation reported concerning their activities during the past year, and the reports of committees were considered as follows:

Action on the recommendations in the report of the committee on college entrance requirements was postponed for one year, with the understanding that the various associations were to take action on it in the meantime, and were to report their decisions to the federation.

The national geometry committee report was approved as a report of progress. The chairman, Dr. Slaught, reported that a preliminary report would soon be distributed to all members of the federation who were engaged in mathematics teaching, as well as to such other teachers as were interested. An edition of 5,000 copies will be published, the expense being borne by the National Educational Association.

The amendments reorganizing the council by limiting the representation of each association to one member were adopted, as follows:

Section 5. Each association shall have one delegate on the federation council, this delegate to cast one vote for every fifty members of the association he represents, but to have at least one vote. The delegate may be chosen in any way decided upon by his association, shall hold office for three years, or until the appointment of his successor, and shall be eligible for reelection. In case of a vacancy by death or resignation, the association in question must at once appoint a successor.

Section 7. The duty of a delegate shall be to keep the secretary of the federation informed as to the activities of his association, and to represent the interests of his association at every meeting of the council. If for any reason he can not attend a meeting, he shall be responsible for being represented by a properly accredited proxy.

The associations have been asked to appoint these representatives at once, and it is hoped that the new council will soon be in full working order.

The treasurer reported as follows:

EXPENDITURES

Stationery and stamps	$ 8.50
Printing and mailing	70.52
National Geometry Committee	100.00
	$179.02
Balance	85.78
	$264.80

RECEIPTS

Balance from 1910	$ 85.60
Dues from 12 associations	179.20
	$264.80

One association, the Association of Biology Teachers of New York, has resigned from the federation, and two associations with an approximate membership of 150 have not yet paid their dues for the year.

A committee of teachers of physics, J. A. Randall, Pratt Institute, Brooklyn, chairman; W. R. Pyle, Morris High School, New York City; W. A. Hedrick, McKinley Manual Training School, Washingon, D. C.; G. A. Works, Madison, Wisconsin; P. B. Woodworth, Lewis Institute, Chicago, has been appointed "to coordinate new apparatus and new teaching content with the present secondary school physics course."

Mr. Randall is chairman of a similar committee of the New York State Science Teachers' Association, and committees to cooperate in this work have already been appointed by the Physics Club of New York and the New Jersey State Science Teachers' Association. It is hoped that the National Educational Association will decide, at next summer's meeting, to be a partner in this undertaking, as it has been in the work of the National Geometry Committee.

The plan of work for the committee is to have each member act as chairman of a local committee, which shall investigate conditions in its territory, collecting data as to new apparatus and improvements in courses to be submitted to the general committee, and giving to the instrument makers plans for whatever apparatus seems worth while. The general committee will probably form a new definition of the "physics unit" to correspond with what they find to be the most improved usage in the subject, and will perfect machinery by which every physics teacher in the country can secure the most improved forms of equipment.

On Thursday morning, at a joint session with Section L of the American Association for the Advancement of Science, the members of the council listened to addresses by Professor C. W. Moore, of Harvard; Professor A. L. Jones, of Columbia, and Dean J. R. Angell, of Chicago University, on the new systems of admission to these colleges.

Eugene R. Smith,
Secretary

Polytechnic Preparatory School,
Brooklyn

ANTHROPOLOGY AT THE WASHINGTON MEETING FOR 1911

THE annual meeting of the American Anthropological Association was held in the United States National Museum, Washington, D. C., December 27–30, 1911, in affiliation with Section H of the American Association for the Advancement of Science and the American Folk-Lore Society. The attendance was good and the program exceptionally long and interesting. The most important features were the two symposia: (1) "The Problems of the Unity or Plurality and the Probable Place of Origin of the American Aborigines," discussed by J. W. Fewkes, A. Hrdlička, W. H. Dall, J. W. Gidley, A. H. Clark, W. H. Holmes, Alice C. Fletcher, Walter Hough, Stansbury Hagar, A. F. Chamberlain and R. B. Dixon; and (2) "Culture and Environment," discussed by J. W. Fewkes, Clark Wissler, Edward Sapir and Robert H. Lowie. The first of these two discussions is printed in full in the January–March issue of the *Anthropologist*, and the second will appear in the April–June issue. Dr. J. Walter Fewkes presided at the six sessions in charge of the American Anthropological Association; also at the single session of the American Folk-Lore Society, in the absence of Professor Henry M. Belden, president of that society. Professor George T. Ladd, vice-president of Section H, was chairman of the single session in charge of the section. The social functions to which members of the affiliated societies were invited included: a reception by Dr. and Mrs. Robert S. Woodward at the Carnegie Institution, a reception at the New National Museum, and the opening of the Corcoran Gallery of Art.

SECTION H

Officers for the Washington meeting were nominated as follows: member of the council, Dr. Ales Hrdlička; member of the general committee, Dr. Charles Peabody. Sectional offices were filled by the nomination and election by the general committee, of Dr. J. Walter Fewkes, Bureau of American Ethnology, as vice-president for the ensuing year; Dr. Alfred M. Tozzer, member of the sectional committee to serve four years (to fill a vacancy), and Dr. Pliny E. Goddard, member of the sectional committee to serve five years.

President Fewkes opened the first public session of the joint meeting with the following remarks:

Ladies and Gentlemen, Members of the American Anthropological Association:

A year has passed since the last meeting of the association and we have now again gathered together, bringing from field and laboratory new material to lay before our fellow workers for their critical examination. It is eminently fitting that we should hold our service in this beautiful building erected by the nation to contain the precious collections gathered from the uttermost parts of the earth as well as our own country. Part of these collections illustrate the physical and cultural history of man, the sciences we cultivate. Our place of meeting should stimulate us with a new enthusiasm and a high ideal of research, and the time of year a new sense of the service to humanity it requires. Although our science has a very practical side, its strength lies primarily in the study of truth for its own sake and thereby the elevation of human character. With your assistance it shall be our effort to eliminate, as far as possible, all personal feeling in our discussions and keep continually in mind the noble ideal that all our work is a service to science.

It has seemed desirable to group our communications in such a way that discussions of methods and principles would be a prominent feature, and it is earnestly hoped that these discussions may be untrammeled by personal feeling, critical when necessary, but always on the highest possible plane. It is evident to all that with so many speakers, all of whom we desire to hear, it may be necessary sometimes for a speaker to curtail his remarks to conform to the time allowed by the committee. Although in such condensation he may feel that he can not do himself full justice, it is to be hoped that he will make the sacrifice for the sake of others who follow.

ADDRESSES AND PAPERS

The address of retiring Vice-president Roland B. Dixon of Section H on "The Independence of the Culture of the American Indian" is printed in SCIENCE of January 12, 1912.

In the absence of President Henry M. Belden, of the American Folk-Lore Society, his address on "Folk Poetry in America" was read by Dr. Charles Peabody.

Many of the important papers read at the joint meeting are represented in this report by abstracts. These are:

Investigations among the Plains Indians: CLARK WISSLER.

A preliminary statement of the general plan

for work by the American Museum of Natural History among the Northern Plains tribes and the southwestern Indians was presented in brief, followed by a general comparative résumé of the results in the Northern Plains. Attention was called to recent evidences for the former use of pottery by the Blackfoot Indians and its apparent similarity in type to that used by the Menominee and the Saulteaux. The chief discussion, however, was confined to ceremonial bundles of the Blackfoot, special attention being called to the great uniformity of structure in the rituals belonging to the same, suggesting that all had a common origin. Certain striking similarities to Pawnee rituals were pointed out as well as correspondence with the Cheyenne. It was noted, however, that the Blackfoot bundles seem to be of a distinct type as opposed to those of the Menominee, Winnebago, Osage, Sauk and Fox, etc. The individuality of the Blackfoot bundle scheme is shown in the peculiar transfer conception by which a bundle may pass from one person to another without restriction. There was also an investment feature in the transfer, that is, while considerable property changed hands when the bundle was secured, the owner could at any time secure an equivalent return by transferring the bundle to another. The transfer-investment character of Blackfoot rituals has not so far been reported among other tribes and may remain tentatively as a Blackfoot characteristic.

Problems in the Ethnology of the Crow and Village Indians: Robert H. Lowie.

One problem in the ethnology of the Northwestern Plains is the extent of Caddoan influence. It is certain that one form of the pipe ceremony was introduced by the Arikara among the Hidatsa and thence traveled to the Crow. It is further possible that the origin of the earth lodge among the Hidatsa and Mandan is due to the same tribe, and accordingly it is necessary to study the Arikara-Pawnee culture in order to ascertain what other elements of the culture of the Upper Missouri may be reasonably traced to this source. A second problem suggested by a comparison of the Hidatsa and Crow is that of cultural differentiation among genetically affiliated tribes. The Crow and the Hidatsa are linguistically very closely related and must have separated in relatively recent times; nevertheless, the main features of their social and ceremonial life differ to such a degree that a purely cultural comparison could not satisfactorily establish a genetic relationship between them. A third problem is the character and development of the "age" societies. It appears that certain features of these societies are widely diffused over the entire Plains area, while the system of age grades is confined to but five tribes. The essential factor in entering the age societies is purchase. An historico-critical investigation of the conceptions of these societies expressed in the writings of Maximilian, Schurtz and Kroeber is highly instructive as to the methods employed in ethnological thinking.

The Principle of Convergence in Ethnology: Robert H. Lowie.

Dr. Graebner in his "Methode der Ethnologie" denies that the principle of independent development is logically on a par with that of historical connection in the explanation of resemblances. He also regards convergent evolution as involving assumptions as to a mystical psychological unity of mankind. Neither of these views is justified. More especially, the apparent mysticism in the doctrine of convergence disappears at once if the supposed identities are recognized not as ethnological realities, but as logical abstractions—not as homologies, but as analogies.

Notes on the Material Culture of the Rio Grande Pueblos: Herbert J. Spinden.

The cultural conditions found in the southwest may be explained by divergent evolution due to a different economic use of the land. The aridity acted as a natural barrier against a people in the hunting stage, becoming one in the agricultural stage. The change could only be accomplished by cooperation in the building of irrigation ditches, etc., and by corresponding changes in the habits of life.

The nomadic tribes used the soil extensively. They gathered natural fruits and followed the chase. The sedentary tribes used the soil intensively. They irrigated the soil, built permanent villages and cultivated the household arts of weaving and pottery making. The minor features of material culture show the fundamental bond between the sedentary Indians of the southwest and the nomadic Indians of the Plains and Plateau. The following rough classification of the arts may be of interest.

Arts largely resulting from the change to sedentary life: architecture; pottery; weaving; decorative symbolism; use of white clay in cleaning buckskin; rattles of deer hoof, etc.; use of heart line in realistic art; occurrence of horned and plumed serpents in realistic art; use of sand paintings.

Features of extremely wide distribution not given in the above list: coiled basketry; bags or cloths of yucca fiber, Indian hemp, etc.; fire drills and pump drills; tubular pipes; grooved stone axes, arrowheads, etc.; flageolettes, flutes, drums, tambourines, etc.

Features that are probably of southern origin: metates; compound arrows with reed shafts; corn and other agricultural products; details in textiles and ceramics.

Features suggesting connections with the Plains and Plateau: buffalo shields and covers; war whistles; scalping knives; war lances and other regalia; deerskin shirts and leggings; porcupine quill decoration; decoration of buckskin by perforation; buffalo and elk hide blankets with decorated strip; rabbit-skin blankets; war-bonnets; sinew-backed and horn bows; double quiver with separate bow and arrow cases; grooved arrow rasps and polishers; flint flakes of bone; perforated arrow straighteners; self arrows with blood grooves and painted rings; wickerwork carrying baskets built on a foundation of two crossed sticks; fish trap made by converging walls and willow mat; mats of sewn tule; saddle made of two long narrow cushions; skin dressing tools; use of brains in tanning.

Some Aspects of the Negro Problem: ALBERT ERNEST JENKS, University of Minnesota.

Immigration.—Since we have a serious negro problem is it reasonable that this problem be made more difficult by admission into the United States each year of an increasing number of un-Americanized immigrant alien negroes?

There are no United States laws against such immigration. Just short of 40,000 such persons have come to this country in the last ten years; in 1911 we received 6,721. They come from near at hand—three fourths coming from the West Indies. The West Indies have nearly 6,000,000 negroes, any of whom may come to the United States. America debars oriental peoples, not because they are inferior, but because they and their culture are so different from American people and culture. For the same reason we should exclude the "African black." He should also be excluded because his admission is unfair to the white and also to the negro American—since he makes even more difficult one of America's most perplexing problems.

Miscegenation.—There are two forms of negro-white miscegenation: (1) Legal marriage, permitted in twenty-three states where the unions are largely between negro men and white women; (2) illegal, more or less temporary unions, usually between white men and negro women. Investigation in a certain area shows that 65 per cent. of the white wives of negro men are foreign-born girls—usually of Teutonic peoples. Over two per cent. of children are born to these marriages. The result of both these forms of miscegenation is an increasing number of mulattoes cemented by color and prejudice to the negro race, while by inheritance they are endowed to a considerable degree with Anglo-Saxon initiative, will, ideals and desire for a square-deal—which, because of their color, they can seldom get. These mulattoes are the migrants in the north and west of the United States; they are more migrant than the restless, foot-free white American. The mulatto is the chief factor in the negro problem; the problem is bound to increase, then, in geographic area, in number of discontented negroes, and in its intensity, hand in hand with the increased flow of Anglo-Saxon blood into the veins of this new American man. All forms of miscegenation between the two races should be made a felony, punishable for one offence; and the father of children born to one white and one negro parent should be held to support and educate such children.

Who is a Negro?—The negro should be defined uniformly, so that there would be no question of the legal and racial status of any given person, no matter in what commonwealth he may be. To-day there is no such uniformity of laws.

Murderous Race Riots.—The white man's passion against the offending, or suspected, negro is often nothing short of blood vengeance against the negro race. This is seen in the fact that assault against the virtue of a white woman is only one of some three dozen offences for which negroes are annually lynched. In many of these lynchings and burnings murder is not committed in the frenzy of the moment; the mob starts out to lynch or burn—the crime is premeditated. If America is to train her annual armies of immigrant recruits into law-respecting and law-abiding citizens, she must punish to the limit necessary all participants in murderous race riots.

Education.—Each negro child should have, so far as public and private schools are concerned, an equal opportunity with the white child to make of himself all that he is capable of being.

Investigation.—A commission should be selected to study every aspect of the negro problem. This

commission might well be financed by private funds so as to keep it from the almost certain bias of politics and sectionalism.

Presentation of Specimens of Eolithic Form from Salinelles (Gard), France: Charles Peabody.

Dr. Marignan (Hérault) recently discovered chipped flints, which he considers to be eoliths. In spite of their localization the specimens are eoliths in facies probably rather than in actual age. Noteworthy is a series of discoidal hammers. The natural fractures of the flint and the outlines of the stones were carefully noted and compared with specimens from the Kent Plateau, Boncelles, etc.

Cacimbas of the Isle of Pines (Cuba): J. Walter Fewkes.

The word cacimba, varying in form, apparently found in several linguistic stocks, is widely spread in aboriginal Latin-America, from the Andes in South America to the larger Antilles. It is supposed by most linguists and by natives generally, to be a purely aboriginal term signifying a receptacle or, in a slightly changed form, possibly another word, a pipe. In the Isle of Pines it is applied to a hill with reservoir-like depressions, and to a landing place called "Embocadero de los Casimbas," near Sigunea Bay, but mainly to certain artificial subterranean, vase-shaped receptacles occurring in various localities. The cacimbas are always constructed under ground, where they are either cut out of the solid rock or built of rude masonry. In a few instances the lower portion is excavated and the upper or neck is formed of a wall of undressed stone.

About thirty of these structures were examined in various localities in the Isle of Pines, others being reported from the south coast of the western end of Cuba. They occur near to or far from the banks of rivers, some distance from the seashore, in woods or open fields, singly or in clusters. The largest number was found near Nueva Gerona and Santa Fé, the latter situated in the middle of the island, where considerable quantities of turpentine were once made, as indicated by remains of ovens of undoubted Spanish manufacture. Isle of Pines cacimbas are accompanied, especially where the surface of the ground has not been greatly disturbed, by low circular mounds depressed in the middle but with raised rims varying from twenty to thirty feet in diameter, situated about the same distance away and overgrown with guano prieta or black-bark palmettos and underbrush. The cacimbas average about five feet in depth; four feet is the greatest diameter and the narrowed, neck-like entrance, the rim of which is sometimes elevated a foot above the surface, has an orifice large enough to admit the human body. Their inner surface is generally smooth, plastered and blackened, the mortar in which the stones are laid being black, as if impregnated with tar. The floor is flat, circular, sloping slightly to the center, where, in one instance, there is a groove connecting with a covered trench which opens on the hillside. A thin layer of tar was found covering the floors of several examples. When these cacimbas were cleaned out they were discovered to be about half full of rubbish, damp soil, débris and decaying leaves. No aboriginal implements or human bones occur in any of them, but there were in one a few fragments of Spanish pottery and the broken jaw of a domestic hog, with other animal skeletal remains. The moist earth in some cacimbas is a favorite habitation for the Cuban crayfish, many specimens of which were taken from one of these structures near Mr. Allnuts's home a short distance from Nueva Gerona. Trenches dug diametrically across the adjacent mounds revealed black layers containing ashes and charcoal with fragments of tar just below the humus, but no walls or aboriginal objects were observed in these mounds.

The Isle of Pines cacimbas are almost universally, and without hesitation, ascribed by the natives to the Indians. It is sometimes held that they were constructed by Caribs as storage places for tar and other objects, as their name implies, and one intelligent person affirmed that the builders were Indians working under Spanish direction. It is claimed by others that they were made by white men and were used as receptacles for turpentine, the neighboring mounds being the places where this substance was manufactured. One of those who held this opinion claimed that pine logs were so laid on the mound that their ends were brought to the center and application of heat caused tar to ooze from them into a pan or small receptacle, from which it was transferred to the cacimba. No reliable facts that would prove or disprove any of the current theories were obtainable, but it is certainly strange, if these structures are of Indian manufacture, that no aboriginal objects or implements were ever found with them. Under the circumstances their origin remains one of the unsolved problems of the West Indian culture history. However, the opinion of a very intelligent native of advanced years, who claimed

that he was a descendant of one of the Comarco Indians of the Isle of Pines, is worthy of record. He said that he had been told by his father, who came from Camaguey, that they were constructed by the Indians and that he had never heard that white men made them or used them as turpentine receptacles. Two cacimbas, situated about three miles from Nueva Gerona where the road to El Bobo forks, sending a branch to McKinley, are called Cueva de los Indios, although there is no cave in the vicinity.

The morphological resemblance of the cacimbas to the chultunes of Guatemala and Yucatan is great. Cacimbas are ordinarily smaller and differ from chultunes in not containing aboriginal objects. If the structures are Indian and pre-Columbian, of which I confess doubts, this unique fact is significant as being the only resemblance thus far found in the antiquities of western Cuba and the neighboring peninsula of Yucatan. No evidence can be presented to indicate that they are related to the cave men of Cuba or to those Indians whose skeletal remains were found in the Cueva de los Indios near Nueva Gerona.

The Chultunes of Northern Guatemala: ALFRED M. TOZZER.

The subterranean cistern-like reservoirs called "chultunes" of northern Yucatan as described by Mr. E. H. Thompson in his paper on "The Chultunes of Labna" seem to have been intended primarily for the storage of water. They are found in most cases in regions where there are no natural sink-holes or cenotes or other available source of water. In a few cases they may have been used as burial blaces.

In northern Guatemala the country is well watered and there is little need of cisterns for the storage of rain-water. The chultunes, however, are far more frequent than in the peninsula to the north. A large number were mapped along the route taken by the Peabody Museum Expedition of 1909–1910. They seem to stretch in long lines connecting the various ruined centers in this region. In addition, several were found in close proximity to the cities themselves.

The chultunes of this region are of two types, the simple cistern-like subterranean chamber similar to those in the north and the lateral-chambered chultun. This second type is met with far more frequently than the first and consists of a room excavated out of the rock and opening from the bottom of the shaft.

From the fact that these chultunes occur in many places where there is an abundant supply of water, it may be argued that the storage of water is not the primary object of these subterranean rooms. Some were no doubt used as burial places. From a large lateral-chambered chultun at Yaloch a large collection of excellent Maya pottery has been taken out. From the manner of occurrence it seems probable that there was a burial here on the floor of the chamber, although no bones of any kind were found still existing in the three feet of earth which had been deposited in the chamber. Three examples of a tall bottomless type of vase were found which are unique. Covers to jars were also common.

Chultunes were also excavated at Chorro, Nakum and Holmul. From the large number of extensive groups of ruins in this area and the hundreds of small mounds and chultunes connecting these centers with one another, together with the examples of pottery from this region, it may be seen that here in northern Guatemala we have perhaps the most important center of the Maya culture.

The Mexican Maize Season in the Codex Fejérváry-Mayer: STANSBURY HAGAR.

On sheets 33 and 34 of the Codex Fejérváry-Mayer (Loubat edition) are two series of symbols including four paintings on each page, two above, two below. The four upper symbols, reading from right to left in the usual manner, picture the maturing of the maize crop during a period of four months: the lower symbols represent the deities governing the months mentioned. But the writer has presented evidence in a previous paper upon the "Elements of the Maya and Mexican Zodiacs"[1] that this sequence of deities also represents the zodiacal signs Cancer, Leo, Virgo and Libra. These signs correspond with the months July, August, September, October, which correctly represent the maize season described upon the Mexican plateau.

A Study of Biological Paleogeography in its Bearing on the Origin of Man in America: AUSTIN H. CLARK.

From a study of the geographical distribution of animals we find indicated: (1) an Indian Ocean land extending from the Lesser Sunda Islands (Sumbava to Timor) to Ceylon, Madagascar, the Mascarene Islands and southeastern Africa; (2) an Afro-Antillean land extending from the Mascarene Islands and Madagascar across south cen-

[1] Sixteenth Int. Cong. of Americanists, pp. 277 et seq.

tral Africa to the West Indies and the highlands of South and Central America (including the Galapagos Islands); (3) a South Sea Island land bounded by Formosa (Taiwan), southern Japan, the Hawaiian and Marquesas Islands, New Zealand, New Caledonia and the Lesser Sunda Islands (but not New Guinea), possibly including Java, Sumatra, Borneo, Celebes, the Philippine Islands, and the Malayan region; (4) a large Australian continent including Australia, New Guinea and the Aru Islands (but not the Ki Islands nor the islands further west or north); (5) a connection between southern Australia and the Magellanic region; and (6) a very broad strait including the entire Behring Sea and the adjacent Arctic Ocean as far at least as Wrangel Island and the New Siberian Islands. 1 and 2 became disintegrated and disappeared at a very early date, probably long before the existence of man; 3 became submerged, first on the eastern border, very early, also probably before the existence of man; 5 disappeared very early, but persisted late enough so that much of the southern South American fauna entered that continent from Australia by means of it; it is possible that man also entered South America along this path and later entirely lost his Australian character through amalgamation with the true American stock from the north; this would account for certain Australian characteristics found among the Fuegians; 6 persisted long after man inhabited eastern Asia; it was thus probably the path by which man entered America.

The People of Sandao-a: Elizabeth H. Metcalf.

In the extreme southern part of Mindanao, the most southern and largest of the Philippine Islands, on the foothills of the beautiful volcano which the Spaniards call "Apo" (The Grandfather), live the Bagobos, a pagan tribe of high mentality, docile natures, spectacular in dress, and in some respects very primitive. They call the volcano "Sandao-a" (pronounced Sandowa), "The Sulphurous One." These Bagobos are a mountain people, and to a certain extent nomadic. They understand only the cultivation of mountain rice; and as this necessitates the cutting of a new bit of forest each year for their rice plantation, they are likely to move also each year into the vicinity of the new rice field. Recently they have been brought together into villages by government order. Although the American arrangement of the tribal wards somewhat curtails the political power of the present head Dato, he is still highly esteemed by both natives and Americans.

Formerly the wealth of the people was in slaves, animals, aguns and fine clothes. The days of slavery are past; the aguns, or big gongs, they still possess. These are their most important musical instruments; and the magnificence of tone coloring of many large gongs played together is quite indescribable. The Bagobos have other instruments of percussion, wind and strings, but these large gongs are also for them their medium of exchange, and a man's wealth is usually reckoned by the number of gongs he possesses.

Their clothes are made from hemp fiber, which the people weave into a cloth, unique in manufacture, and which lends itself admirably to the artistic fashion of ornamentation employed by these people. Of the old embroidery of cross-stitch on coarse Chinese cotton cloth, which the women understood fifty or more years ago, there are still a few samples to be found; but the present style of ornamentation consists of an applique in various forms of bright-colored cloth, of embroidery, of beads and tiny pearl disks sewn on in designs. The beads the people purchase from the Chinese merchants, the pearl disks are made from shells, found farther back in the mountains by another tribe living there.

The houses are always built up from the ground —sometimes of bamboo prepared in various ways, sometimes with the frame of wood with the leaves of certain trees laid on thickly for the roof and more openly for the sides. The entrance to the house is by a notched stick or by a ladder, and the furniture is exceedingly simple. A peculiar feature, especially of the houses of the aristocrats, is the different floor levels. At the extreme end of the house, opposite the door, the floor is often raised from 6 inches to 3 feet and the whole width of the house. This place is for guests and for the heads of the family. I have seen a house of an important old Dato with three floor levels; on the highest level only the old Dato and his wife and such persons as they might bid, could come.

The fireplace is usually near the door, with bamboo tubes of water standing on end nearby; the better class have bamboo frames of various kinds for holding dishes, and always in its proper place in every house, even the poorest, is the "Tambara," the little bowl containing the usual offerings, the simplest form of house altar. The greatest of their altars, the "Pat-a-non," or war altar, is also a house altar. The erection of this altar is allowed to only a very few high Datos and is connected with their most important fes-

tival, which occurs some time during rice planting. The most significant ceremonies formerly attended this festival, which might last from two days to two weeks; but as in other regions of the earth, so here, the incoming of commerce and civilization kills the ancient culture; and it is probable that if it is given at all in its entirety, it is only in the remote regions of the mountains, that this great festival of the "Ginum" is now observed with all its elaborate ceremonies. The Bagobos have other altars for different places and different occasions; altars for the planting of their corn or rice; for the cutting of their crops; and very often they place an altar with their offerings near a great tree or a beautiful spring or running water, especially if the water is to be used for any ceremony of purification.

A Note on the Personification of Fatigue among the Nez Percé, Kutenai, et al.: ALEXANDER F. CHAMBERLAIN.

In common with other authorities, Dr. Paul Ehrenreich, in his recent volume, "Allgemeine Mythologie" (Leipzig, 1910), takes the view (p. 159) that personifications of abstract ideas, etc., are of little mythological significance, being almost entirely of cultural or ceremonial import. Such personifications as do exist he regards as not primarily personifications of such qualities, but originally representations of lunar personalities, as, *e. g.*, in the cases of the Greek Hermes-Autolykos (gambling and pleasure) and the gambling-deities of certain North American Indians. According to Ehrenreich, the hunting-gods are "not really personifications of the hunt, but almost always the moon-god, or at least a being furnished with lunar traits" (p. 160). But this is going too far in the way of panlunarism.

Among interesting personifications of abstract qualities among the North American Indians are *sleep* among the Ojibwa (Schoolcraft) and *hunger* among the Shushwap (Teit). Another case is that of *fatigue* among the Nez Percé and the Kutenai.

As Bartels ("Medicin d. Naturv.," Leipzig, 1893) notes (p. 235), citing Bancroft ("Native Races," Vol. I., p. 284), among the Nez Percé there was a ceremonial participated in annually by all the males of the tribe between the ages of 18 and 40. The ceremonial, which lasted for from 3 to 5 days, had, as its most noticeable element the pushing of willow-rods down the throat into the stomach, this being followed by hot and cold baths and fasting. The firm opinion of the Indians is that they thereby obtain great bodily strength and power of resistance to fatigue. The ceremonial is held in order to overcome *Mawish*, the spirit of fatigue. This is the Nez Percé "spring-medicine," reported on recently by Dr. Spinden. There are certain identities and resemblances in Kutenai and Nez Percé mythology, etc., that deserve careful study (one curious item is the presence in each of a character with *one* leg). *Mawish*, of course, is the Chinook jargon word for animal (*e. g.*, deer)—and the deer figures prominently in the dances, etc., of the Kutenai.

Initial and Terminal Formulæ of Kutenai Tales: ALEXANDER F. CHAMBERLAIN.

Although, in the adverb *pik'āks*, the Kutenai language has a word corresponding to our "long ago," "once upon a time," etc., so familiar as an initial formula in the tales and legends of many lands, this term does not appear as the customary beginning of such stories as have been recorded in the native text.

In narration the Kutenai employs the "historic present," as the grammarians term it, adding thus to the vividness of the story told. The great majority of the tales begin with a verb in the present tense, therefore, not with such a phrase as our "once upon a time," with its verb in the past tense. Examples of Kutenai initial formulæ are:

Kānaquē Skínkuts	= Coyote is traveling.
Kānaquē tlántlā	= Grissly-Bear is traveling.
Káusākā'ne Wōtak	= Frog is there.
Kŏnitlăinē Skínkūts	= Coyote is in his house.
Kŏnitlăinē G'ŏtsāts	= Chipmunk is in his house.
Tsináqē Skinkūts	= Coyote sets out (starts off).
Kăktlūnăm'nē	= There is a village.
Nātlqŏnē Djăis	= He carries his brother on his back.

Very seldom is the order as above indicated inverted, as *e. g.*, Mitskăkas Káusāk'ă'nē, "The Tomtit is there." The "Tale of Seven-Heads" begins: Wistătlātlām sāhănē, "Seven-Heads is bad"; a tale of the owl, Kūpī tsăkētlăine, "The Owl is a great thief." The term äswătlnē, "together," begins a tale, as, *e. g.*, Äsmătlnē tsináqē Skínkūts ăqkī Náik'yū, "Coyote and Fox set out together," although the formula Skínkūts äsmătlnē, etc., is also used. Among the Kutenai, as with some other Indian tribes of the Oregon-Columbian region, the coyote who figures so largely in myth and legend is represented as being "on his travels"; so, too, with certain of the other animal characters. Kānáque Skinkūts is the typical be-

ginning of most of the stories in which he plays the chief rôle; tsináqē, "he starts off," "he sets out," is another initial formula of frequent occurrence in the animal-tales. The word Káusāk'āinē signifies "he is at," "he stays," "he stops," "he is there," "he is." Such beginnings are Kŏnitlā́inē, "he is in his house," "he is at home," and Kāktlūnäm'nē, "there is a village," are quite picturesque. Often there is no terminal formula in Kutenai stories. A common term, however, is táqas, "ended," "enough," "done," "finished." The phrase tlātlŏ́nē, "there is no more," also occurs. The terminal Kāpḗt, used by some of the Indians, seems to be the Kopḗt of the Chinook Jargon, modified by supposed derivation from Kutenai K'āpē, "all."

The Allentiacan Linguistic Stock: Alexander F. Chamberlain.

All the evidence in hand indicates that the language (extinct in the eighteenth century; represented by the "Grammar and Vocabulary" of de Valdivia, published in 1607 and 1608, reprinted in 1894 by Medina) of the *Allentiacs* or Huarpes forms an independent linguistic stock, the *Allentiacan*, as it may be called. The Allentiacs, according to Boman, were quite a savage people and unrelated to the tribes of the Andean valleys. This Argentinian people inhabited, at the time of the Spanish conquest, the plains about the great lagunes of Huanacache, extending probably to the western slopes of the Sierra de Cordoba, and southward to the northern parts of San Luis and Mendoza. The Allentiac linguistic material has been discussed by de la Grasserie (1900) and Mitre (1894 and 1909).

The Bororoan Linguistic Stock: Alexander F. Chamberlain.

There can be no doubt of the status of the language of the Bororó Indians of Central Matto Grosso (Brazil) as an independent stock, as suggested by von den Steinen as early as 1886, or a little before that. Brinton in his "American Race" (1891) failed to recognize this, or had not noticed von den Steinen's statement, and classed them incorrectly as Tupian. It was only in 1888, as a result of the second Xingú expedition, that the identity of the so-called "Coroados" branch of the stock with the genuine old Bororo was established. Conflicts with the whites have sadly reduced the numbers of the Bororó. Their characteristic area, as defined by Frič (1906), is "the entire course of the S. Lourenco river as far as its union with the Cuyabá, where they come into contact with the Guató." Further north they occupy "both banks of the Araguaya right across the road that leads from Cuyabá to Goyaz." In the first half of the eighteenth century these Indians roved about the region of the Xingú-Araguay watershed in central Matto Grosso. Later on, the so-called "Borroró do Cabaçal" settled on the upper Paraguay. The vocabulary of 360 words, given by von den Steinen, in his "Unter den Naturvölkern Zentral-Brasiliens" (1894) is the most useful linguistic material of the Bororoan stock. Other vocabularies are given by Caldas (1899) and Frič and Radin (1906)—the last print also a vocabulary from Boggiani.

The Calchaquian Linguistic Stock: Alexander F. Chamberlain.

The character of the Calchaquian language and the extent of the area over which it prevailed have been the subject of much discussion and dispute. Some have held that the Calchaqui, Catamareño, or Cacana tongue was nothing more nor less than a dialect or *patois* of Onechua, spoken in Tucuman, etc. Others seek to connect it with Aymara, Atacameñan, etc. The Calchaquis may have been a mixed people, as Lafone-Quevedo and Ehrenreich maintain. But there was an essential Calchaquian (or Diaguitan, as Boman prefers to call it) culture, and with it went a language, which was still spoken in the seventeenth century, and, from all appearances, seems to have been an independent form of speech, deserving rank as a linguistic stock. Boman (1908) failed to find any trace of the existence in Paris of the grammar and vocabulary of Calchaqui said to have been written by the Jesuit missionary Alonso de Barzuna (or Barcena) in the sixteenth century. The Calchaquian linguistic data consist of place-names, etc., discussed, *e. g.*, by Lafone-Quevedo, in his "Tesor de Catamarquenismos" (1898). At its greatest extent the Calchaquian (rather than Catamarcan or Diaguitan) stock may be said to have occupied a territory of varying breadth, between about 23° 30′ and 32° 30′ S. lat. For the archeology of this region much knowledge is due to the researches of Ambrosetti, his colleagues and students.

Recent Opinion as to the Position of the American Indians among the Races of Man: Alexander F. Chamberlain.

The author discussed briefly the various theories in the light of the scientific literature of the past

few years—the autocthonous, the European, the Asiatic. The protagonist of the theory of the autocthonous origin of American man is Professor Ameghino, the Argentinian paleontologist, who derives him from the higher simians in southern South America. Professor G. Sergi, the Italian anthropologist, who looks with some favor on Ameghino's views, recognizes—he takes a rather polygenetic view of human origins—among his separate human races a *facies Americana*. The old view of Boyd Dawkins (resurrected by him, in a somewhat modified form) that the Eskimo are the representatives or the descendants of European cave-man still finds favor in certain quarters, but the recognition of the interior origin (in the region east of Hudson Bay) of the Eskimo as demonstrated by Boas, etc., places this theory rather out of court. That the American race is simply a Mongolian type, a view once much in favor, has lost its standing since the results of the Jesup North Pacific Expedition have become known. The data acquired concerning the so-called "paleo-Asiatic" peoples (Chukchee, Konaks, Kamchadales, Yukaghir, etc.) of northeastern Asia and the peoples of northwestern North America, demonstrate that the "paleo-Asiatic" people, at least (as the Asiatic Eskimo did later) must have crossed from America to Asia long subsequent to the arrival of the ancestors of the American race from Asia (if they came by way of Bering's Straits, as now seems reasonable). The American Indians may thus be considered as an Asiatic people (sprung from the proto-Mongolian stock), considerably modified by their New World environment. By a refluent wave of migration they have "Americanized," as it were, a large section of northeastern Asia.

The Mourning Ceremony of the Southern Paiutes: EDWARD SAPIR.

The main ceremony of the southern Paiutes of Utah, Arizona and Nevada is an annual mourning ceremony or "cry." The expenses of such a ceremony, which generally lasts for five days in June or July, are borne by two men, one of them a close relative of a recently deceased member of the tribe. Sometimes neighboring bands are invited to take part in the ceremony. The place of the mourning ceremony varies from year to year and is decided upon at a preliminary council meeting. The essential elements of the ceremony are the singing of numerous mourning songs and the offering of valuables, such as baskets, articles of clothing and horses, in memory of the dead.

The songs, which are accompanied by rattles held by each singer, are to be classified into four sharply distinguished types, roan songs, bird songs, coyote songs, and mountain sheep songs. Each of these has its characteristic type of melody and accompanying movements on the part of the singers. There does not seem to be any idea of a grouping of the participants of the ceremony into four societies singing these different types of songs; one may join in the singing of any class of songs and leave one group of singers for another. There is, however, a song leader for each type of song. This merely means that certain people are proficient in the singing or composing of particular classes of songs. The texts of the songs are in comparatively few instances in Paiute, but belong to a language that is unintelligible to the singers. There is reason to believe that the types of songs, the actual song-texts, and perhaps the whole ceremony are borrowed from the Yuman tribes to the west. There is a possibility that the song texts consist of an elaborate system of burdens.

At various stages during the singing, which forms the major part of the ceremony, ceremonial "cries" take place which are conducted by a cry leader. On the last night of the mourning ceremony, during which it is forbidden to sleep, the articles which have been set aside as offerings to the dead are burned on a funeral pile; horses are shot, valuable articles which have been exposed as offerings may be taken by others and replaced by objects of less value. It is evident that the Paiute mourning ceremony bears considerable resemblance to mourning ceremonies of various Californian tribes.

Cephalic Type Contours: WILLIAM C. FARABEE.

The main object aimed at in all physical measurements is to find characters that shall be peculiar to the race or group of people under investigation. Under the old methods little attention was given to actual measurements of characters, except in so far as they aided in the determination of ratios or indices. The various indices for each individual were calculated and the average and range determined for the whole group. It was believed that these ratios were more constant than were the absolute dimensions and hence general conclusions were based upon the ratios obtained from short series.

Recently, improved methods have shown that these ratios have as wide range of variability as the measurements themselves and it has been found necessary to apply rigid statistical methods to the actual dimensions. The most constant characters of a large number of individuals must be observed and selected for measurement. In the past the head measurements have been considered of most importance and most constant. For the Harvard Expedition to South America De Milhau devised a cephalometer which allowed one to take measurements from the center of the auricular passage to any desired position on the head or face. For comparative group studies these dimensions were most satisfactory. Yet one very important factor was lacking, viz., the angle between the lines, which prevented any possibility of graphic presentation. To overcome this defect and to minimize as far as possible the importance of definitely locating all the positions mentioned, a protractor was attached to record these angles. This made it possible to locate the points to which the measurements were made, whether or not the positions were correctly determined. All measurements and angles were taken with reference to the horizontal plane of the Frankfort agreement. The vertical height is perpendicular to this plane and this line is marked zero in the scale.

When all results have been worked out according to correct statistical methods it will be possible to plot the *means* of all angles and measurements and when the ends of these lines have been connected by means of a spline a *type contour* will result. In the same way type contours of different related or unrelated groups in races may be made. These contours should be plotted on thin paper and superposed for comparative study. The advantage of the method is that it may be applied to the cranium as well as to the living head and direct comparisons made to determine relationships. Head measurements may be reduced to cranium measurements by allowing for the thickness of the cranial tissues.

Some Factors in the Differentiation of Human Types: Robert Bennett Bean.

Dr. Bean has studied random samples from four groups of mankind, Europeans, Africans, East Indians and Filipinos, and in each group three types that are similar in physical characteristics may be segregated. He has heretofore called these three types Primitive, Australoid and Iberian, but here they will be designated *A*, *B* and *C*, respectively.

Type *A* is small, brachycephalic and platyrrhine.

Type *C* is tall, dolichocephalic and leptorrhine.

Type *B* is medium in stature, mesocephalic or mesaticephalic and platyrrhine.

From the standpoint of growth other factors may be utilized to differentiate the types. It is known that the relative total leg and arm length increase from birth to maturity, the face increases in size, and the umbilicus descends. To make these factors relative we may use the length of the leg in relation to stature, the length of the arm in relation to stature, the size of the face in relation to the size of the head and the position of the umbilicus in relation to the position of the suprasternal notch and the symphysis pubis. Dividing the length plus breadth of the face by the length plus breadth of the head gives a cranio-facial index, which is low at birth and high at maturity. Dividing the distance of the umbilicus from the symphysis pubis by the distance of the umbilicus from the suprasternal notch gives the omphalic index, which is high at birth and low at maturity.

The three types may be assembled by the use of these factors according to the stage of development that each represents, as follows:

Type *A* Hypo-onto-morph	Type *C* Meso-onto-morph	Type *B* Hyper-onto-morph
	Relative total arm length	
Small	intermediate	large
	Relative total leg length	
Small	intermediate	large
	Cranio-facial index	
Small	intermediate	large
	Omphalic index	
Large	small	?

Type *A* is less developed than type *B*, and type *C* is intermediate.

Additional factors, mainly descriptive, have been utilized to differentiate the three types, the form of the external ear or pinna enabling one to classify any individual after close scrutiny. The distinctive differences of ear form refer particularly to the inversion or eversion of the outer rim of the concha, and the rolling in (forward) or rolling out (backward) of the helix. These changes are especially to be seen at the lower part of the ear in the region of the tragus and antitragus, and the helix and antihelix. The ear of type *A* has an inverted concha—the tragus and antitragus appear to be pushed in—and an inrolled helix, giving it a trumpet or bell shape. The ear

of type *C* is the reverse of this: the concha is everted—the tragus and antitragus appear to be pulled out—and the helix is rolled back at its lower part. The ear of type *B* appears to be intermediate between these extremes. The ear type is more distinctive than any other factor, and may be utilized more readily, therefore it is more serviceable.

The nose form is useful in the differentiation of type, although it is not so good as the ear form. The nose of type *A* is infantile. The bridge and root are wide and depressed, the nostrils flare and open forward rather than downward. The nose of type *B* is wide, long and high, with depressed root, straight, high bridge and nostrils that are wide and open only slightly forward and downward. The nose of type *C* is narrow, long and high with high root and bridge and nostrils that open downward.

The soundness of the teeth in types *A* and *B* is noteworthy, whereas the teeth of type *C* are very unsound.

Type *C* is more susceptible to diseases of the epithelial tissues, or those organs derived from the primary epithelium, such as the alimentary canal and the central nervous system; whereas types *A* and *B* are more susceptible to diseases of the mesothelial tissues or the organs derived from the primary mesoderm, such as the circulatory system.

Types *A* and *B* seem to be linked together in many respects, and in this they are different from type *C*, which seems a more clearly differentiated type than the other two. The three types differ slightly in the different groups of mankind, and resemble the type that is distinctive for each group. For instance, type *A* is distinctive for the Filipinos included in the present study, therefore types *B* and *C* resemble type *A* among the Filipinos; type *B* is distinctive for the Africans, therefore types *A* and *C* resemble type *B* among the Africans; and type *C* is distinctive for the Europeans and East Indians, therefore types *A* and *B* resemble type *C* among these peoples.

Type *C* apparently retains its characteristics in all the groups more specifically than do the other types. As this type is so distinct in at least the four groups thus far studied, besides forming such a considerable part of these four groups, Dr. Bean concludes that this type in the four groups originated from the same stock. He therefore believes that the tall long-headed blond northern European, the small long-headed brunette southern European, the tall long-headed, straight-haired black East Indian and the tall long-headed, kinky-haired African are derived from this original stock. Their ear form is identical, and other factors confirm this evidence. Existing differences may be accounted for by hereditary, climatic and cultural conditions.

Linguistic Classification of Algonquian Tribes: TRUMAN MICHELSON.

Algonquian tribes linguistically fall into four major groups, to wit, Blackfoot, Cheyenne, Arapaho and Central-Eastern. The last may be subdivided into Central and Eastern. Of the Central subdivision, Ojibwa, Ottawa, Potawatomi and Algonquin form a special branch; and Peoria, etc., distinctly belong with them, but the latter are further removed from the others than any one of those from each other; moreover Peoria, etc., in certain respects are more archaic in their phonetics, and in some grammatical categories have more northern affinities. Menominee has the closest relations with Cree-Montagnais, though also is intimately connected with Fox, etc. Fox, Sauk and Kickapoo vary from each other but slightly; the differences are mainly in intonation and idiom. The first two are more nearly related than either is to Kickapoo. The last is closer to Fox than to Sauk. The three distinctly belong with Cree-Montagnais and Menominee as opposed to Ojibwa, etc. Shawnee is very close to Fox, Sauk and Kickapoo, but in certain respects agrees with Ojibwa, etc., and in others the Eastern subdivision. Natick clearly belongs with the Central and not the Eastern subdivision. In some categories it has affinities with the Ojibwa branch, but in others it is varied; and has some marked characteristics of its own. Delaware decidedly belongs to the Central and not the Eastern subdivision despite the popular notion to the contrary. The material in Zeisberger is a medley of Unami, Unalachtigo, Munsee. It is sufficiently clear that the linguistic relations of these were different; but the existing material is so unsatisfactory that it is premature to make any definite statement. The Eastern subdivision consists (to-day) of Micmac, Passamaquoddy, Malecite, Penobscot, Abenaki. Micmac is specialized in that it employs a conjunctive instead of independent mode; but the popular notion that it differs widely from the other members of the subdivision is mistaken, as is the belief that the Eastern subdivision belongs with Delaware. On the contrary the relations of the group are distinctly with Fox, etc., and Shawnee.

Dr. Michelson's paper is to appear in amplified form as one of the "Accompanying Papers" in an "Annual Report of the Bureau of American Ethnology."

The Status and Development of Canadian Archeology: Harlan I. Smith.

The archeological work of the Geological Survey since June 15, 1911, the date of Mr. Smith's appointment as dominion archeologist, has been divided into two main groups—the activities for diffusing archeological knowledge by such means as museum exhibits, guide books and lectures, and those for increasing such knowledge by exploration, original research and systematization.

The national collections have been classified tentatively into groups corresponding to the five ethnological culture areas. This grouping may be modified with the progress of research. The collection from the southern coast of British Columbia and the one from the southern interior of British Columbia are representative, and the collection from Ontario is large. The other provinces of the Eastern Woodlands, the Plains and the Arctic are hardly represented at all, and there are practically no data at hand concerning them. Popular guides have been prepared for the two western archeological areas, and work is progressing upon similar guides for the others. A series of lantern slides illustrating the archeology of Ontario has been made; general and topical labels for the collection are in the hands of the printer; duplicates of these will probably be furnished to the other museums throughout Canada, which with duplicate specimens, casts and photographs, when supplied to these museums, will make the archeological work truly national.

An archeological survey of the dominion is being organized, a reconnaissance has been made of some of the village sites in Ontario, and a survey of Brantford Township has been completed by Mr. W. J. Wintemberg. A scheme for systematizing and digesting the scattered and incomplete archeological data at hand and to be received in the future has been inaugurated. The cooperation of railroad officials, the northwest mounted police, Indian agents and geological explorers has been secured.

It is proposed to explore the less well known parts of Canada, beginning with intensive exploration at one site in each of the great cultural areas, in order that the results in the way of collections and monographs may be used as standards to which to refer for identification the results of future exploration obtained in bordering areas where we may expect to find mixed or superimposed cultural material.

It is planned in the near future to make a reconnaissance of the Plains from which there is practically no material to-day available, to continue scientific exploration into the northern interior of British Columbia, using the Grand Trunk Pacific as a base, and to do an intensive piece of excavation along the St. Lawrence. Next the shell-heaps of the Atlantic coast may be examined.

The papers read of which the secretary was unable to obtain abstracts were:

The Anthropology of the Pueblos: A. Hrdlička. To appear as a bulletin of the Bureau of American Ethnology.

Notes on the Words and Music of the "White Captive" Ballad: Charles Peabody.

A Comparative Sketch of the Menominee: Alanson Skinner.

Quechua Folk-Music: W. C. Farabee.

The Analysis of Chippewa Music: Frances Densmore.

The Permanent Protection of the American Indian: Franklin W. Hooper.

Notes on the Chippewyan, Sarcee and Kiowa Apache: Pliny E. Goddard.

Amalgamation in Minneapolis: A. E. Jenks.

Results of Field-work among the Hurons of Lorette (Quebec), Anderson (Ontario) and Wyandotte (Oklahoma): C. M. Barbeau. To be printed in full in one of the annual reports of the Geological Survey of Canada.

The following papers were read by title:

William Carter, Bensontown Homer: Phillips Barry.

An Early Cranium of Homo sapiens from a Cavern at Unterlesece, near Trieste: Harris H. Wilder.

The Distribution of the Spear-thrower in South America: M. H. Saville.

Some Analogies between the Pottery of the Southwest and that of the Predynastic Period in Egypt: A. V. Kidder.

Early History of the Yuchi Indians: John R. Swanton.

The Relation of the Quickness of Learning to Retentiveness: D. O. Lyon.

Cayuga Notes: Grace E. Taft.

George Grant MacCurdy
Yale University